31336 VIA COLINAS, WESTLAKE VILLAGE, CA 91361

SMOKE SIGNAL BROADCASTING

DISK SYSTEMS

```
                    1:          OPT    NOG
                    2: * TTL DOS COMMON EQUATES
                    3:
                    4: *  DOS68 SYSTEM PROGRAMMING EQUATES
                    5:
6000                6: SYSBAS EQU    $6000         BASE ADDR FOR THIS SYSTEM
                    7:
6880                8: DOSFCB EQU    SYSBAS+$0880 DOS FCB ADDRESS
69FF                9: SYSSTK EQU    SYSBAS+$0A00-1 SYSTEM STACK TOP
6A00               10: EXTDOS EQU    SYSBAS+$0A00 EXTENDED DOS LOGIC
6D00               11: LINBUF EQU    SYSBAS+$0D00 SYSTEM LINE INPUT BUFFER
6D80               12: TCA    EQU    SYSBAS+$0D80 ORG OF TRANSIENT CMD AREA
7280               13: DOSJMP EQU    SYSBAS+$1280 DOS JUMP TABLE
7300               14: PARTBL EQU    SYSBAS+$1300 PARAMETER TABLE
7380               15: DOSBAS EQU    SYSBAS+$1380 BASIC DOS LOGIC
7780               16: DFMORG EQU    SYSBAS+$1780 BASE ADDR OF DFM
                   17: *
                   18: * PARAMETER TABLE DEFINITION
                   19: *
7300               20: YMONV  EQU    PARTBL+$00   DISK MONITOR VERSION
7302               21: YMEMAX EQU    PARTBL+$02   USER MEMORY LIMIT
7304               22: YLINAD EQU    PARTBL+$04   LINE BUFFER ADDRESS
7306               23: YLINPT EQU    PARTBL+$06   LINE BUFFER RESET ADDR
7308               24: YBSCHR EQU    PARTBL+$08   BACKSPACE CHARACTER·
7309               25: YDLINE EQU    PARTBL+$09   DELETE LINE CHARACTER
730A               26: YLPAUS EQU    PARTBL+$0A   LINE PAUSE CHAR
730B               27: YLCONT EQU    PARTBL+$0B   LINE PAUSE RESUME
730C               28: YABORT EQU    PARTBL+$0C   ABORT CHARACTER
730D               29: YABRTV EQU    PARTBL+$0D   ABORT VECTOR ADDRESS
730F               30: ZHCINT EQU    PARTBL+$0F   HARD COPY INITIALIZE
7312               31: ZHCOUT EQU    PARTBL+$12   HARD COPY CHAR OUTPUT
7315               32: YECHOC EQU    PARTBL+$15   MONITOR ECHO CONTROL ADR
7317               33: YCPORT EQU    PARTBL+$17   CONTROL I/O PORT 0=DISABLED
7319               34: YPPORT EQU    PARTBL+$19   PRINTER I/O PORT 0=DISABLED
731B               35: YDEPTH EQU    PARTBL+$1B   LINES/PAGE
731C               36: YWIDTH EQU    PARTBL+$1C   CHARACTERS/LINE
731D               37: YNULLS EQU    PARTBL+$1D   CR/LF NULLS
731E               38: YHCFLG EQU    PARTBL+$1E   HARD-COPY ENABLE
731F               39: YEJECT EQU    PARTBL+$1F   BLANK LINES END OF PAGE
7320               40: YPPPAS EQU    PARTBL+$20   POST PAGE-PAUSE,0=ON.#0=OFF
7321               41: YSYSDR EQU    PARTBL+$21   SYSTEM DRIVE NUMBER
7322               42: YWRKDR EQU    PARTBL+$22   WORK DRIVE NUMBER
7323               43: YCLINE EQU    PARTBL+$23   CURRENT LINE NUMBER
7324               44: YCCOL  EQU    PARTBL+$24   CURRENT CHAR POSITION/COLUMN
7325               45: YUCSWT EQU    PARTBL+$25   UPPER CASE SHIFT LOCK 0=>NOT UC
7326               46: YOSWT  EQU    PARTBL+$26   OUTPUT CONTROL SWITCH
7327               47: YDCMDA EQU    PARTBL+$27   DO COMMAND PROCESSOR ACTIVE
7328               48: YERSWT EQU    PARTBL+$28   SYSTEM ERROR SWITCH
7329               49: YCFLG  EQU    PARTBL+$29   COMMAND LOAD FLAG
732A               50: YLOADE EQU    PARTBL+$2A   LOAD ERROR FLAG
732B               51: YTAFLG EQU    PARTBL+$2B   VALID TRANSFER ADDRESS FLAG
732C               52: YTADDR EQU    PARTBL+$2C   TRAN FER ADDRESS·
732E               53: YOFSET EQU    PARTBL+$2E   OFFSET FOR FILE LOAD
7330               54: YDATE  EQU    PARTBL+$30   SYSTEM DATE STRING
7340               55: YTIME  EQU    PARTBL+$40   SYSTEM TIME STRING
7362               56: EXTTBL EQU    PARTBL+$62   FILE EXTENSION TABLE
                   57: *
                   58: * MONITOR LINKAGES
                   59: *
7280               60: ZCOLDS EQU    DOSJMP+$00   MONITOR COLD START
7283               61: ZWARMS EQU    DOSJMP+$03   MONITOR WARM START
7286               62: ZOUTEE EQU    DOSJMP+$06   CHARACTER OUTPUT ROUTINE(OUTEEE)
7289               63: ZINCH  EQU    DOSJMP+$09   SYSTEM MONITOR INPUT(INEEE)
```

```
728C            64: ZMON    EQU   DOSJMP+$0C  JMP TO ROM MONITOR
728F            65: UCTBL   EQU   DOSJMP+$0F  USER COMMAND TABLE POINTER
                66: *
7291            67: ZFLSPC  EQU   DOSJMP+$11  GET A FILE SPECIFICATION
7294            68: ZGCHAR  EQU   DOSJMP+$14  GET CURRENT CHAR
7297            69: ZGNCHR  EQU   DOSJMP+$17  GET NEXT CHAR
729A            70: ZANCHK  EQU   DOSJMP+$1A  CHECK FOR ALPHANUMERIC
729D            71: ZDIE    EQU   DOSJMP+$1D  DIE, PRINT CMD STRING AND ERROR
72A0            72: ZGETHN  EQU   DOSJMP+$20  GET A HEX VALUE
72A3            73: ZADDX   EQU   DOSJMP+$23  ADD THE B REG TO THE X REG
72A6            74: ZOUTST  EQU   DOSJMP+$26  OUTPUT STRING AT X (END ON $00)
72A9            75: ZTYPDE  EQU   DOSJMP+$29  TYPE THE DISC ERROR MESSAGE
72AC            76: ZOUTHX  EQU   DOSJMP+$2C  PRINT A HEX BYTE
72AF            77: ZOUTHA  EQU   DOSJMP+$2F  PRINT AN ADDR IN HEX
                78: * RESERVED DOSJMP+$32
72B5            79: ZLINEI  EQU   DOSJMP+$35  LINE INPUT ROUNTINE
72B8            80: ZLP     EQU   DOSJMP+$38  FORTRAN LINE PRINTER OUTPUT VECTOR
72BB            81: ZPEEK   EQU   DOSJMP+$3B  PEEK AHEAD AT NEXT CHAR IN LINE BUFF
72BE            82: ZOUTCH  EQU   DOSJMP+$3E  USER ALTERABLE OUTPUT
72C1            83: ZPUTCH  EQU   DOSJMP+$41  DIRECTED OUTPUT VECTOR
72C4            84: ZGETCH  EQU   DOSJMP+$44  DIRECTED INPUT VECTOR
72C7            85: ZSTAT   EQU   DOSJMP+$47  TERMINAL INPUT STATUS
72CA            86: ZRESTR  EQU   DOSJMP+$4A  RESTORE I/O VECTORS
72CD            87: DCMDLN  EQU   DOSJMP+$4D  COMMAND LINE PROCESSOR
72D0            88: ZEXCMD  EQU   DOSJMP+$50  EXECUTE EXTERNAL COMMAND
72D3            89: ZLOAD   EQU   DOSJMP+$53  EXTERNAL CALL LOADER
                90: * SPARE EQU DOSJMP+$56
72D9            91: ZNAMEJ  EQU   DOSJMP+$59  DECODE NAME AND JUMP
72DC            92: ZCRLF   EQU   DOSJMP+$5C  PRINT CR/LF STRING
72DF            93: ZSTEXT  EQU   DOSJMP+$5F  SET FILE EXTENSION
                94: *
                95: * FILE EXTENSION INDEXES
                96: *
0000            97: XBIN    EQU   0           BINARY
0001            98: XTXT    EQU   1           TEXT
0002            99: XSRC    EQU   2           ASSEMBLER SOURCE
0003           100: XBAS    EQU   3           BASIC PROGRAM
0004           101: XCTL    EQU   4           COMMAND CONTROL
0005           102: XBAK    EQU   5           BACKUP TEXT
0006           103: XDAT    EQU   6           DATA FILE
0007           104: XFOR    EQU   7           FORTRAN FILE
0008           105: XTMP    EQU   8           TEMPORARY FILE
0009           106: XSPARE  EQU   9           UNUSED SPARE
               107: *
               108: *
               109: * DFM LINKAGES
               110:
7780           111: ODFM    EQU   DFMORG+0    OPEN DFM
7783           112: CDFM    EQU   DFMORG+3    CLOSE DFM
7786           113: DFM     EQU   DFMORG+6    I/O REQUEST ENTRY
               114:
               115: * FILE CONTROL BLOCK (FCB) INDICES
               116:
0000           117: XFC     EQU   0           DFM FUNCTION CODE
0001           118: XES     EQU   1           ERROR STATUS
0002           119: XUN     EQU   2           UNIT NUMBER
0003           120: XFN     EQU   3           FILE NAME
0009           121: XFE     EQU   9           FILE NAME EXTENSION
000C           122: XFT     EQU   12          FILE TYPE
000D           123: XFS     EQU   13          FILE STATUS
```

```
[illegible]
[illegible]      EQU   [illegible]    JUMP TO ROM MONITOR
[illegible]      EQU   [illegible]    EXIT COMMAND LINE PROCESSOR
*
ZGETFL EQU   DOSJMP+$2D   GET A FILE SPECIFICATION
ZCHAR  EQU   DOSJMP+$[illegible]   GET CURRENT CHAR
ZNXTCH EQU   DOSJMP+$27   GET NEXT CHAR
ZCLASS EQU   DOSJMP+$[illegible]   CHECK FOR ALPHANUMERIC
ZPCR?  EQU   DOSJMP+$[illegible]   [illegible] PRINT CRLF [illegible] ERROR
ZGETHX EQU   DOSJMP+$[illegible]   GET A HEX VALUE
ZADDBX EQU   DOSJMP+$[illegible]   ADD THE B REG TO THE X REG
ZOUTST EQU   DOSJMP+$[illegible]   OUTPUT STRING AT X (END ON $04)
ZRPTER EQU   DOSJMP+$[illegible]   TYPE THE DISC ERROR MESSAGE
ZOUTHX EQU   DOSJMP+$3C   PRINT A HEX BYTE
ZOUTAD EQU   DOSJMP+$[illegible]   PRINT AN ADDR IN HEX
* RESERVED DOSJMP+$[illegible]
ZLINE  EQU   DOSJMP+$1B   LINE INPUT ROUTINE
ZLP    EQU   DOSJMP+$30   FORTRAN LINE POINTER OUTPUT VECTOR
ZPEEK  EQU   DOSJMP+$[illegible]   PEEK AHEAD AT NEXT CHAR IN LINE BUFF
ZOUTCH EQU   DOSJMP+$[illegible]   DOS ALTERNATE OUTPUT
ZOUTCH EQU   DOSJMP+$41   DOS I/O OUTPUT VECTOR
ZINCH  EQU   DOSJMP+$44   DIRECTED INPUT VECTOR
ZSTAT  EQU   DOSJMP+$47   TERMINAL INPUT STATUS
ZRSTR  EQU   DOSJMP+$4A   RESTORE I/O VECTORS
ZDOCMD EQU   DOSJMP+$4D   COMMAND LINE PROCESSOR
ZXCMD  EQU   DOSJMP+$50   EXECUTE EXTERNAL COMMAND
ZLOAD  EQU   DOSJMP+$53   EXTERNAL CALL LOADER
* SPARE EQU DOSJMP+$56
ZNAME  EQU   DOSJMP+$59   DECODE NAME AND JUMP
ZPRT   EQU   DOSJMP+$5C   PRINT ERROR STRING
ZSETXT EQU   DOSJMP+$5F   SET FILE EXTENSION
*
* FILE EXTENSION INDEXES
*
XBIN   EQU   0     BINARY
XTXT   EQU   1     TEXT
XASC   EQU   2     ASSEMBLER SOURCE
XBAS   EQU   3     BASIC PROGRAM
XCTL   EQU   4     COMMAND CONTROL
XBAK   EQU   5     BACKUP TEXT
XDAT   EQU   6     DATA FILE
XFOR   EQU   7     FORTRAN FILE
XTMP   EQU   8     TEMPORARY FILE
XSPARE EQU   9     UNUSED SPARE
*
*
* OPEN LINKAGES
*
ZOPEN  EQU   DPNOPN+0     OPEN DPN
ZCLOS  EQU   DPNOPN+3     CLOSE DPN
ZPEN   EQU   DPNOPN+6     I/O REQUEST ENTRY
*
* FILE CONTROL BLOCK (FCB) INDICES
*
XF?    EQU   0     DPN FUNCTION CODE
XES    EQU   1     ERROR STATUS
XDN    EQU   2     UNIT NUMBER
XFN    EQU   3     FILE NAME
XFX    EQU   [illegible]     FILE NAME EXTENSION
X[illegible] EQU 1[illegible]     FILE TYPE
X[illegible] EQU 1[illegible]     FILE STATUS
```

```
000E          124: XFSU    EQU   14          FIRST SECTOR USED
0010          125: XLSU    EQU   16          LAST SECTOR USED
0012          126: XSUC    EQU   18          SECTORS USED
0014          127: XRFS    EQU   20          RF FILE SIZE
0017          128: XRHBW   EQU   23          RF HIGHEST BYTE WRITTEN
001D          129: XRBA    EQU   29          RF BYTE ADDRESS
001E          130: XCT     EQU   30          CURRENT TRACK NUMBER
001F          131: XCS     EQU   31          CURRENT SECTOR NUMBER
0020          132: XRIM    EQU   32          RF INCREMENTAL MODE
0020          133: XRIF    EQU   32          RF INITIALIZATION FLAG
0021          134: XRID    EQU   33          RF INITIALIZATION VALUE
0026          135: XDB     EQU   38          START OF BUFFER
0026          136: XNT     EQU   XDB+0       NEXT TRACK NUMBER
0027          137: XNS     EQU   XDB+1       NEXT SECTOR NUMBER
0028          138: XPT     EQU   XDB+2       PREVIOUS TRACK
0029          139: XPS     EQU   XDB+3       PREVIOUS SECTOR
002A          140: XSOD    EQU   XDB+4       START OF DATA
              141:
              142: * DFM FUNCTION CODES  (XFC)
              143:
0000          144: QFREE   EQU   0           REPORT FREE SPACE ON DISC
0001          145: QSO4W   EQU   1           OPEN FOR WRITE
0002          146: QSWRIT  EQU   2           WRITE
0003          147: QSWC    EQU   3           WRITE CLOSE
0004          148: QSO4R   EQU   4           OPEN FOR READ
0005          149: QSREAD  EQU   5           READ
0006          150: QSRC    EQU   6           READ CLOSE
0007          151: QDEL    EQU   7           DELETE
0008          152: QREN    EQU   8           RENAME
0009          153: QAPP    EQU   9           APPEND
000A          154: QDIRI   EQU   10          DIRECTORY INITIALIZATION
000B          155: QDIRT   EQU   11          DIRECTORY TRANSFER
000D          156: QRAFC   EQU   13          READ ACTIVE FCB CHAIN
0010          157: QLOGD   EQU   16          LOG IN A SYSTEM DRIVE
0011          158: QLOGE   EQU   17          EXAMINE SYSTEM DRIVE NUMBER
0012          159: QSSR    EQU   18          SINGLE SECTOR READ
0013          160: QSSW    EQU   19          SINGLE SECTOR WRITE
0014          161: QCRF    EQU   20          CREATE A RANDOM FILE
0015          162: QORF    EQU   21          OPEN A RF
0016          163: QPRF    EQU   22          POSITION A RF
0017          164: QRRF    EQU   23          READ A RF
0018          165: QWRF    EQU   24          WRITE A RF
0019          166: QCLSRF  EQU   25          CLOSE A RF
001C          167: QERF    EQU   28          EXPAND RANDOM FILE SIZE
              168:
              169: * DFM ERROR CODES  (XES)
              170:
0001          171: EIFC    EQU   1           INVALID DFM FUNCTION CODE
0002          172: EFE     EQU   2           FILE EXISTS
0003          173: EFIB    EQU   3           MASTER FILE DIRECTORY ERROR
0004          174: EFB     EQU   4           FILE IS IN USE
0005          175: ENSF    EQU   5           NO SUCH FILE
0006          176: EEOF    EQU   6           END-OF-FILE
0007          177: EDF     EQU   7           DISC FULL
0008          178: EIF     EQU   8           INVALID FILE CONTROL B
```

```
OCK (FCB) ADDRESS
0009            179: EIFN   EQU   9           ILLEGAL FILE NAME
000A            180: EFS    EQU   $A          FILE STATUS ERROR
000B            181: EITS   EQU   $B          INVALID T# OR S# ON @SSR OR @SSW
D0@ED)          182: EIUN   EQU   $C          INVALID UNIT NUMBER (ONLY 0,1,2,3 AL
000E            183: EDR    EQU   $E          DISC READ ERROR
```



```
000F            184: EDW    EQU   $F          DISC WRITE ERROR
0010            185: EIFT   EQU   $10         ILLEGAL FILE TYPE
0011            186: ENER   EQU   $11         NOT ENOUGH ROOM TO CREATE FILE
0012            187: EWP    EQU   $12         FILE IS WRITE PROTECTED
0013            188: EDP    EQU   $13         FILE IS DELETE PROTECTED
0014            189: EFSE   EQU   $14         RANDOM FILE SIZE ERROR
0015            190: EDWP   EQU   $15         DISC IS WRITE PROTECTED
0020            191: ENSD   EQU   $20         NON-SYSTEM DISC IN LOGGED DRIVE
0021            192: ESFF   EQU   $21         SYSTEM FILE FORMAT ERROR
0022            193: ECSS   EQU   $22         CHECKSUM ERROR ON SYSTEM FILE
                194: *
                195: *  FILE TYPE CODES  (XFT)
                196: *
0001            197: FTCS   EQU   1           SEQUENTIAL COMPRESSED
0002            198: FTSQ   EQU   2           BINARY SEQUENTIAL
0004            199: FTRB   EQU   4           BYTE MODE RANDOM
0005            200: FTRR   EQU   5           RECORD MODE RANDOM
                201: *
                202: *  FILE STATUS CODES  (XFS)
                203: *
00              204: FANA   EQU   0           NOT ACTIVE
0001            205: FASR   EQU   1           SEQUENTIAL READ
0002            206: FASW   EQU   2           SEQUENTIAL WRITE
0004            207: FARA   EQU   4           RANDOM ACCESS
                208: *
                209: * PRINT CODES
                210: *
000D            211: CR     EQU   $D          CARRIAGE RETURN
000A            212: LF     EQU   $A          LINE FEED
0020            213: SP     EQU   $20         SPACE
0000            214: EOS    EQU   0           END OF STRING
```

```
0000: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0010: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0020: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0030: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0040: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0050: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0060: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0070: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0080: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0090: 0000 0000 0000 0000 0000 0000 0000 0000  ................
00A0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
00B0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
00C0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
00D0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
00E0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
00F0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0100: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0110: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0120: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0130: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0140: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0150: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0160: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0170: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0180: 0000 0000 0000 0000 0000 0000 0000 0000  ................
0190: 0000 0000 0000 0000 0000 0000 0000 0000  ................
01A0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
01B0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
01C0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
01D0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
01E0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
01F0: 0000 0000 0000 0000 0000 0000 0000 0000  ................
```

SSB DISK SYSTEM REFERENCE MANUAL

INTRODUCTION

How much do you want to read? If you are like most people, you would rather start up the system right away and read the instructions later. This manual is designed to get you up and running with a minimum of reading; however, to become proficient at system operation, you will need to read the entire manual thoroughly.

If you have a Chieftain Microcomputer System, you may skip right to the section "Getting It Up".

If you have another type of microcomputer, you should first read the section "Installation Instructions" which includes information on hardware requirements and minimum CPU clock frequency.

PART 1: INSTALLATION INSTRUCTIONS

UNPACKING

Carefully remove the disk system from its shipping container. Remove the disk controller board. Remove the protective packing material wrapped around the board. Inspect both disk system and controller board for any shipping damage. Any damage should be reported to the shipping agent.

HARDWARE REQUIREMENTS

In order to use your disk system you will need:

1. An operational SS-50 BUS 6800 computer or its functional equivalent. The system should contain:
   a) 8K of RAM at $6000 thru $7FFF and RAM from $A000 through $A07F. In addition, a minimum of 16K of RAM from $0000 through $3FFF will be required to run certain system programs.
   b) Nothing that would interfere with the controller PROM at $8020 or PIA at $9FFC. This does not apply to the Chieftain System.

MINIMUM CLOCK FREQUENCY

The minimum processor clock frequency for operation of the minifloppy systems is 0.85 MHz. For the 8" systems, the minimum clock frequency is 1.65 MHz. Most 6800 computers now in use operate with a clock frequency near 1.0 MHz. Thus, unless you are using one of the SSB Chieftain Series of 2 MHz processors, you may have to modify your computer to operate at a higher clock frequency when using an 8" disk system. This is easily done and results in your programs all running nearly twice as fast.

If you are converting an existing 1 MHz system, a 1.8 MHz clock frequency is recommended. Most likely the MOS integrated circuits supplied with your 1 MHz system will operate satisfactorily at 1.8 MHz. If you experience problems, however, all the 6800 series components are available in a "B" series which is guaranteed to operate at 2 MHz. The 6800 may be replaced by a 68B00, a 6820 or 6821 by a 68B21 etc.

NOTE: The SWTP MP-16 will not operate above approximately 1.05 MHz because of the method used to refresh its dynamic memory chips. The SSB M-16A uses static memory and every board is tested at 2 MHz. If you have a MP-16, check with your local dealer to determine his policy on a trade-in allowance towards a M-16A.

The SWTP MP-A CPU board may be converted to 1.8 MHz operation as follows:

(1) Cut the trace between pin 5 of IC-20 and pins 12 and 13 of IC-19.
(2) Connect a jumper from pin 3 of IC-20 to pins 12 and 13 of

IC-19.

The SWTP MP-A2 board may be modified for 1.8 MHz operation by changing capacitor C-1 to approximately 30 pf. The exact value should be determined experimentally and a low temperature coefficient capacitor should be used to minimize frequency change caused by changes in operating temperature.

TO INSTALL IN YOUR SYSTEM

1. MAKE SURE ALL POWER IS REMOVED FROM THE COMPUTER SYSTEM.
2. Read the hardware requirements section of the installation instructions and make certain your system has not been modified to be incompatible with the SSB disk system.
3. Install the controller card in any of the large slots so that the component side faces forward.
4. Install the disk interface cable. (Use J-2 for 5" systems or J-3 for 8" systems). When adding additional drives, refer to the section on "Installing Additional Drives".
5. Apply power to the disk system by plugging it into the 115 volt power source and pressing the power switch. The power switch is on the front panel of the BFD-68 and on the rear panel of the LFD-68 and DFD-68.
6. Power may now be reapplied to the computer.

!!! CAUTION !!!

Never turn power on or off to the disk system or to the computer to which the disk system is attached while a diskette is installed in any of the drive units. During power on or off, a false write could occur which may destroy the data stored on the diskette.

!!! IMPORTANT !!!

Read the limited warrantee and software license information in this manual prior to using the system.

This completes the hardware installation. To get the software going, read the section "GETTING IT UP".

A WORD ABOUT DISK DRIVES

Smoke Signal Broadcasting uses two types of minifloppy drives in the disk system: Shugart Associates SA400 drives and Microperipherals Inc. B51 drives. These drives are functionally equivalent but have two diferences. One is physical; The SA400 has a different front panel from the B51. Both operate essentially the same. Diskettes are inserted into the drives with the label facing the left side of the system. The edge of the diskette with the long oval cutout should be the first edge of the diskette to enter the drive. The other difference has to do with the speed at which at which the stepper motor moves the

head. For the SA400, it takes about 40 milliseconds per step; the B51 takes about 12 milliseconds. Consequently, the interface using MPI drives will not work with the SA400 drives due to the faster stepping speed. However, the B51 drives will work with an interface using the SA400 drives.

Shugart Associates SA800 drives are used in the single sided 8" disk systems and SA850 drives are used in the double sided 8" systems. The controller supplied with any 8" system will operate with both the SA800 and SA850 without modification.

PART 2: GETTING IT UP

CHECK YOUR SYSTEM

Before you run DOS68, you must make sure that your system is up and running under your ROM monitor. Prior to loading DOS68 into memory, you should be familiar with the disk bootstrap operation. If you are already familiar with this, skip the explanation and continue with "BOOTING DOS68".

The initial loading of software into a computer with little or no permanently resident software involves a process called bootstrapping. Bootstrapping is the use of a typically small, dumb program to load a larger, smarter loader which in turn can load the desired program (usually the operating system) into the computer.

The ROM supplied on the BFD/LFD controller board or the CHIEFTAIN monitor EPROM contains a bootstrap loader capable of reading and executing a second loader located in sector 0 of track 0 from a disk mounted in drive 0. The contents of this sector is first initialized by the FORMAT program, then LINK'ED to contain information to cause DOS68 to be loaded and executed. "LINKING" the disk is a process whereby the boot routine is told what file to load and run when the disk is booted. (See the LINK command description.)

BOOTING DOS68

Now select the disk with DOS68 version 5 at memory locations $6080 through $7FFF. (Check the system out with DOS68 located in this memory range. Later if you wish to use DOS68 at one of the higher address ranges, read the section "DOS68 AT HIGHER MEMORY ADDRESSES".) To boot DOS68, place the system disk into drive 0 and transfer control to the ROM/EPROM bootstrap loader. BFD/LFD users can initiate the boot with either the SMARTBUG Q command or by performing a Jump to $8020. In CHIEFTAIN systems, the Q command should be used. Booting in this manner is referred to as "COLD STARTING" because all monitor and DFM temporaries are initialized. (Once DOS68 has been loaded into memory, it is possible to WARM START the monitor, that is, to restart the monitor without initializing everything by transferring control to the warmstart address of DOS68. Refer to APPENDIX A for the warmstart address of your DOS.)

INSTALLING AND CONFIGURING DOS68

DOS68, when booted or cold started, will attempt to run the command:

```
EXEC,START.UP
```

This requires the utility EXEC.$ and an exclusive file named START.UP found on drive 0. The START.UP file is a procedure file containing a series of DOS68 commands which can be selected to set system parameters as you would like them. For your

convenience, DOS68 is supplied with 2 procedure files which will provide simple system configuration at boot time. The file SMART.BUG is set up for the SSB SMARTBUG environment, and SWAT.BUG is for the SWTP SWATBUG environment.

SSB has designed DOS68 to work with these "standard" monitors. Therefore, if you are using some other monitor, you should read the technical sections of the manual to determine the changes to DOS that might be required for your monitor.

Initially, the START.UP file does not exist, so the first time you boot up DOS68, the system terminal will double echo. So, the first thing you should do is select one of the "BUG" files and rename it to bear the name "START.UP". Type the following after the "DOS:" prompt:

```
        RENAME,SMART.BUG,START.UP
or      RENAME,SWAT.BUG,START.UP
```

Next, push the reset button on your computer and reboot DOS68. You should now be fully up and running. If you will be using a printer with the system, read the section "Installing DOS68 Printer Drivers". Otherwise, you you are ready to run any command or program. For example, to bring up BASIC, simply type the command: BASIC

At this time it is a good idea to make a backup copy of your system disk and place it in permanent storage. Formatting and disk Backup are explained in Part 3 of the manual. After making a backup copy, you may safely run BASIC and need only read the remaining parts of the manual when you desire to learn more about the disk operating system, DOS68.

To configure DOS68 to meet your individual requirements at boot time, you may want to create a custom START.UP file to contain the commands you need. Be sure to read the description of the SET command to fully understand how to set the system parameters. We would suggest experimenting with your system parameter settings as commands from the terminal, and then using the BUILD command, generate trial procedure files to execute with the EXEC command before renaming them to bear the name "START.UP"

NOTE 1: The BFD/LFD ROM as well as the CHIEFTAIN EPROM will utilize memory locations $7000 to $707F and $7F80 to $7FFF when boot loading. This holds true even if the program being booted does not reside in the $7000 range.

INSTALLING DOS68 PRINTER DRIVERS

DOS68 is supplied with both source and load modules for both serial and parallel printer drivers. The serial driver module is named SPRINT.SYS, and the parallel driver is named PPRINT.SYS. You should select the appropriate driver for your type of printer, and use the RUN command to load and initialize the driver. As an example:

```
RUN,PPRINT.SYS
```

will load and initialize the parallel printer driver PPRINT.SYS. SSB suggests for your convenience that you include a RUN command for the driver module you select within the START.UP file so that you will automatically be set up for hardcopy when you boot up.

Since the source code for both drivers is supplied, you are free to examine and perhaps modifiy the drivers to accomodate any special hardware requirements.

Unless the HARDCOPY location has been changed using the SET command, PPRINT.SYS will expect to use a parallel card located at port 6. SPRINT.SYS will default to a serial card in port 2B for a chieftain and port 3 for other systems.

DOS68 AT HIGHER MEMORY ADDRESSES

Disks with DOS68 Version 5 located at $A080 through $BFFF and $C080 through $DFFF are also supplied. This allows the user to have the entire lower 32K available for user programs, except during boot operations. The boot routine will use $7000 through $707F and $7F80 through $7FFF while it loads the monitor into the higner addressing region. After loading the monitor, the entire $7000 block is available to the user, except when using the EXEC utility which uses the area from $7E00-$7FFF. (See description of EXEC command for other locations at which EXEC is supplied).

The Smoke Signal Broadcasting M-16A 16K memory board may be switch selected to occupy $A000 through $DFFF and, thus, can provide the memory required to operate DOS68 at the higher addresses. When the M-16A is used at that location, a simple modification to the SWTPC MP-A CPU card is required. Modification instructions are given in the M-16A manual. No modifications are required to the SWTPC A2 card; however, the on board RAM at $A000 must be switched off. When using the SSB Super Computer Board - 68 (SCB-68), the onboard RAM must be selected for the $F000 - $F3FF memory location only (refer to the appropriate CPU documentation).

When using the higher addressed versions of DOS68, all programs which access the monitor or DFM in the $6000 through $7FFF area should be changed to access corresponding locations in the higher addresses.

TROUBLESHOOTING BOOT PROBLEMS

If you cannot get DOS68 to boot in, you may have hardware problems. Some commonly encountered problems are:

1. The head loads and unloads without DOS68 printing its banner. This may be due to no memory or faulty memory between $6000 and $7FFF. Read the section on hardware requirements.

2. Disk seems to be working, but no results. Two possibilites:
   a) Since all the ICs are in sockets, some may have been dislodged in shipping. To make sure, push in all the ICs and try again.
   b) The head carriage assembly on the disk drive may have been stuck or loosened during shipping. To free it, power down the disk system and, with the eraser end of the pencil or a finger, move the head assembly back and forth to make sure it is free. Then position the carriage so that the stylus is in the groove on the stepper motor cam. Then try booting the system again. This problem is confined to the Shugart SA400 5" disk drive.

PART 3: OPERATING DOS68 VERSION 5

INTRODUCTION:

The DOS68 command set consists of both memory resident and disk resident (Transient) commands. Memory resident commands reside in memory as part of DOS68. Transient commands reside on a disk as files with names bearing a "$" filename extension. Disk resident commands are loaded into memory and executed when the command is invoked. This facility offers two distinct advantages: 1) the resident monitor is smaller because all the command processors need not be resident in memory, and 2) the user is easily able to implement new monitor commands without modification of the monitor. For these reasons, the majority of the DOS68 command set has been implemented as disk resident command processors.

Moreover, the transient command scheme offers the users of multi-disk systems the ability to specify that the command is to be found on a specific disk drive. This feature is particularly useful when invoking transient commands which might conflict with a command found on another disk. To invoke a transient command residing on a specific drive, the command is entered by preceeding the command name with the drive number followed by a colon, ':'. For example, 2:LIST,1 will retrieve the LIST command processor from disk drive 2 to list the directory for drive 1. All commands will default to be called from the system drive unless specified as above. Any target file will default to be retrieved from the work drive. (See the SET parameter command description for the method of defining the system and work drive numbers).

COMMAND DESCRIPTIONS:

DOS68 indicates its readiness to accept a command by displaying "DOS: " on the terminal. At this time a new command line may be entered.

ENTERING COMMANDS

Commands given to DOS68 are entered on a line input basis. This means that the entire line is typed in before DOS68 begins to process it. Using such line input gives the user a chance to easily correct typing errors or to completely cancel the line before DOS68 starts any processing. The previously entered character can be deleted by typing a control H, which is the backspace (BS) character. To delete the entire line, type the delete line character, (DL) which is defined as control X. It is important to note that the character definitions for the DL and BS characters are user definable using the SET command, so you can redefine the backspace (BS) or delete line (DL) character definitions to meet your specific system requirements.

RE-EXECUTING COMMANDS

DOS68 provides you two methods for recalling the last command for re-execution . First, to recall the last entered command for re-execution, type a control D. DOS will immediately re-display and re-execute the command.

Second, to recall the last command to either display it, or to display it and modify it, enter a control A. DOS68 will display the previously executed command, leaving the line buffer pointer, and your terminal's cursor pointing at the termination character of the line. You can now edit the line by backspacing and entering the changes. Typing a carriage return will cause the command line to be executed. The DL (delete line) character will cancel the line.

DOS68 is supplied with the following commands:

	COMMAND NAME	FUNCTION:
	APPEND	Merges two files together to form one file
	BACKUP	Makes a backup copy of an entire disk
	BUILD	Build command control file
	CONCAT	Allows merging text files into a new file
PIP	COPY	Allows files to be copied from disk to disk
ERA	DELETE	Remove a file from a disk
DO	EXEC	Execute command control file
*	EXIT	Exit to other resident monitor
	FIND	Type map of file address information
	FORMAT	Format a blank disk
*	GET	Load a binary object file into memory
	GETH	Load a hex formatted object file
*	GOTO	Go to hex specified address
	LINK	Set up information to boot the monitor
DIR	LIST	List the disk file directory
*	P	Initialize for terminal output to printer
	REPAIR	Repair (edit) a sector on the disk.
REN	RENAME	Change the name of a file
*	RUN	Load a file into memory and begin execution
	SAVE	Save memory into a file
	SAVET	Save transient area memory into a file
	SDC	Single disk drive copy
	SET	Set system parameters
TYPE	VIEW	Type contents of an editor text file

(* indicates a memory resident command)

The following conventions are used to describe files under DOS68:

The disk drive unit numbers are 0, 1, 2 and 3.

Angle brackets, < >, are used to enclose a string of characters to indicate that the string indicates one item. For example: <UNIT NUMBER> is used below to represent the disk unit number for a file.

If a field in a command is optional, the optional portion is bracketed in square brackets. For example: [,<UNIT NUMBER>] means that the comma followed by a unit number is optional.

Many files require the specification of a file; <FILE SPEC> will be used as an abbreviation for the following:

[<UNIT NUMBER>:]<FILE NAME>[.<EXTENSION>]

where <FILE NAME> may be one to six alphanumeric characters and <EXTENSION> may be up to three alphanumerics.

Some legal file specifications might be:

1:FILE.ONE	A file called "FILE.ONE" on unit number 1
ABC.1	A file called "ABC.1" assumed to be on work unit
FNAME	A file called "FNAME" assumed to be on work unit
0:FILE.ONE	Note that 0:FILE.ONE is different file from 1:FILE.ONE

RESIDENT COMMAND DESCRIPTIONS:

This section describes those DOS68 commands which are memory resident. It is not possible to specify a disk unit number for retrieving these commands since these commands are not transient commands.

EXIT — EXIT:

The exit command returns control to the resident ROM monitor. The exit is made by using a jump table entry whose address is specified in the "DOS68 MEMORY MAP" table. The address of the ROM monitor entry point can be changed by changing this table entry.

GET — GET,<FILE SPEC>[,<OFFSET>]:

The GET command loads the file specified into memory and returns to the monitor. <OFFSET> is an optional hex value which when entered is added to the load address of the file.

For example:

```
GET,GOING           Load the file "GOING" from the work drive
GET,1:XYZ           Load the file "XYZ" into memory from disk 1
GET,PROG.BIN,1000   Load "PROG.BIN" $1000 locations above
                        the specifed load addresses
```

GOTO — GOTO,<HEX ADDRESS>:

The GOTO command is provided for convenience. It is used to start execution of a program already loaded into computer memory. <HEX ADDRESS> is a 1 to 4 digit hex number representing the address where program execution is to commence. The primary reason for using the GOTO is if there is a program already loaded into memory and you do not wish to load it off of the disk again. Caution must be exercised that the program really exists and has not been changed since it was last loaded.

For example:

```
GOTO,100      Transfer computer control to location $0100
```

P — P,<COMMAND LIST>:

The P command is unique and unlike any others currently in DOS68. P signals the system I/O drivers to route the output of any command through the system printer driver. This is very useful for getting printed copies of the disk directory via LIST or to print the contents of a text file with the VIEW command. Proper P command operation requires that an appropriate printer driver like SPRINT.SYS or PPRINT.SYS has been initialized with the RUN command prior to using P. The ideal time to initialize the driver is at Boot time with a RUN command for the driver included in the START.UP file so the necessary vectors in the SYSTEM

PARAMETER table will already be set up. The required vectors are the port address of the printer, and the initialization and character output addresses of the driver. s If these vectors have not been initialized, the P command will not enable printer output but will continue to output characters to the system terminal.

For example:

```
    P,LIST              Print directory of drive 0 on printer device
    P,VIEW,LAST.MSG     Print file "LAST.MSG" located on the work
                         drive on the system printer
```

RUN RUN,<FILE SPEC>[,<OFFSET>]:

The RUN command performs the same function as the GET command except that if a transfer address was given when the file was saved, this address will be transferred to once the file has been loaded. NOTE: the RUN command has the same optional offset load capability as the GET command. The offset will also be added into the transfer address. It is the user's responsibility to know if a file can be run when loaded with an offset.

EXAMPLES:

```
    RUN,2:GAME.1            Run the file "GAME.1" on disk 2
    RUN,1:PROG.REL,1000     Load with a $1000 offset and
                             run "PROG.REL"
```

TRANSIENT COMMAND DESCRIPTIONS:

This section describes the disk resident commands supplied with DOS68. DOS68 can be told to search a specific disk for any of the following commands by preceeding the command name with a unit specifier such as "1:" to indicate unit 1. If the unit number is omitted, the system drive unit number will be assumed (i.e. unit number defaults to system drive).

APPEND — APPEND,<THIS FILE>,<THAT FILE>:

The APPEND command allows two files to be merged into one file. The file specified by <THIS FILE> is appended to <THAT FILE> where both files are assumed to reside on the disk specified by the file specification of <THAT FILE>. Once appended, the file name of <THIS FILE> is removed from the disk directory. Note that if the drive number of <THAT FILE> is not specified that the work drive will be assumed as the default drive.

FOR EXAMPLE:

```
APPEND,FILE.ONE,2:FILE.TWO
```

This causes the file "FILE.ONE" on disk drive 2 to be appended to file "FILE.TWO" on disk drive 2. The file "FILE.ONE" will cease to exist on disk 2.

BACKUP — BACKUP:

THE BACKUP command allows the user to make a complete image copy of a of a disk mounted in drive 0 to a disk in drive 1.

BACKUP makes a complete disc image of the master disc by transferring all the data, on a track by track basis. Therefore, if the files on the master disc are physically scattered, the image copy of the master disk will in turn reflect the same physical file layout. To duplicate a disk to ensure a "contiguous" file layout, use the COPY utility with a freshly formatted diskette. Since BACKUP transferrs the LINK'ed boot information, system disks duplicated with BACKUP will not require re-LINKing.

When invoked, BACKUP will prompt the user with its banner. Then the user is prompted to place the master disk (the disk to be copied) in drive 0.

Make sure that the disk you intend to be the new copy is mounted in drive 1, as BACKUP will write on every track and sector of the disk , effectively eliminating all the files which existed prior to executing BACKUP.

When the disks are mounted and you are ready to proceed, type a car carriage return. The BACKUP operation will then begin. A successful disk BACKUP operation requires that the disk in drive 1 does not contain any bad sectors. * Do not attempt to intermix single sided and double sided diskettes when using BACKUP. SSB

suggests using COPY to obtain favorable results.

BACKUP has a number of error messages that report the various error conditions that may occurr during the backup operation. These error messages are self explanatory.

BUILD BUILD,<FILE SPEC>:

The BUILD command is provided for those desiring to create a small text file quickly (such as START.UP files or EXEC files). The main purpose for BUILD is to generate short text files for use by the EXEC command.

BUILD has the general command form:

BUILD,<FILE NAME>

where <FILE NAME> is the name of the file you wish to create. The default extension for the file is Type 4, which is initially 'CTL'. The unit number in which the file will be created is that of the work drive. If the output file has already been created, the prompt "DELETE OLD FILE? " is issued. If the file is OK to delete the user is expected to respond with 'Y'es. Failure to responed with Yes will terminate the build session since the file currently existing cannot be used for writing.

After you are in the BUILD mode, the terminal will respond with the '#:' prompt. To enter your text simply type on the terminal the desired text, keeping in mind that once the carriage return is entered the line is in the file and may not be changed. Any time before the carriage return is entered the functions defined for line input are available for text editing. To terminate the build session, entry of a carriage return (null line) will write the remainder of the file to the disk file, close the file and return to DOS68.

CONCAT CANCAT:

The CONCAT concatenates text files together by reading input files and transferring their contents to an output file. At the conclusion of an input file transfer, the output file remains open for additional input file transfers. When the user no longer wishes to append another file, the output file is closed. The contents of the output file reflects the order in which the input files are specified.

CONCAT allows the user to specify input files located on any drive regardless of the drive on which the output file is assigned. For example, a file on drive 0 and another file on drive 1 can be CONCATenated to form an output file on drive 2.

In using CONCAT, it first prompts the user by asking for the output file. After an output file has been specified, CONCAT

then prompts the user for the name of the first input file. After the first input file has been specified, the contents of the input file are transferred to the output file. Next, CONCAT will ask if you want to append a file. Respond with a Y or N. If the user responds with Y then CONCAT will ask for the next input file name. Once entered, the next input file will be read and transferred to the output file. At the conclusion of this and subsequent input file transfers, CONCAT will continue to ask you if you want to append another file until you enter a N response, at which time the output file will be closed. As part of the output file closing process, CONCAT will mark the end of file with an EOF character (control Z). This is done to ensure text file compatability with upward compatabile software.

COPY COPY,<FROM>,<TO>:

The COPY command provides a means for copying files. COPY has the general command form:

COPY,<FROM>,<TO>[<SWITCHES>]

Where <FROM> specifies the source of information to be copied, <TO> specifies the destination, and <SWITCHES> represents the specification of various options. COPY will use the WORKING DRIVE value for <FROM> and <TO> if either is omitted from the command line (refer to SET for further explanation).

Either <FROM> or <TO> may reference "$"-files (e.g. LIST.$), and either may be an ambiguous file specification. An ambiguous file reference uses the characters "?" and "*" as part of the file name to reference a family of files as opposed to a specific file reference. "?" is a wild-card character which is used to mean "any character in this position". "*" is a wild card field which when used in a file reference means "treat this field as if it were filled with "?"s.

Examples:

.	means all files
*.OBJ	means all files with an extension of "OBJ"
SAM.*	means all files with a file name of "SAM"
*.$	means all command (i.e. $-sign) files
A?????.HEX	means all files with an extension of "HEX" where the file name starts with the letter "A"
Z?.*	means all files where the file name is two characters long and starts with "Z"

NOTE: "1:" is treated the same as "1:*.*"

The function of the COPY command is to copy all files specified

by <FROM> to files specified by <TO>. The only restrictions as to what may be done are restrictions of common sense. For example: COPY,1:*.$,2:ABC makes no sense since this tries to copy all command files on drive 1 to a single file, ABC, on drive 2.

COPY,1:*.OBJ,2:*.HEX is a valid statement which says to copy all files on drive 1 with an extension of "OBJ" to drive 2, but in the process changing "OBJ" to "HEX" for each file copied.

COPY,1:A?????.*,2:Z?????.* says to copy all files on drive 1 which start with the letter "A" to drive 2 while changing the "A" to a "Z".

COPY 1:?A????.* 2:?Z????.* says to copy all files from drive 1 which have an "A" as the second letter to drive 2 while changing the second letter to a "Z".

COPY has one other feature which allows the user to abort the COPY command by typing CONTROL 'C. COPY uses the control port status routine of DOS68 to determine if the user has attempted to abort the command. COPY returns control to DOS68 after the present file which is being copied is finished. (Refer to SET command for further explanation).

<SWITCHES> represents the specification of 1 or more of the following options:

"/NV" No Verify. The default mode of operation is to verify all files copied by reading back the output file and comparing it to the input file data.

"/C" Confirm. COPY will print the file name of the next file to be copied and then wait for the operator to say yes ("Y") or no ("N") to the copying of that file when the confirm option is specified.

"/L=n" Memory limit. The memory limit option is used to limit the amount of memory used by COPY. COPY normally assumes that 16K of RAM starting at 0 is available for use. The "n" specified represents the high order digit of the next 4K of memory NOT available for use by copy (the default is /L=4). "n" may be the numbers 1 through 7 for 4 through 28K.

"/P" Partial. The partial option forces COPY to copy as much possible of a file which has a read error thats preventing the entire file from being read. Otherwise, the remainder of the last buffer read will not be written when the read error occurs.

Examples of using COPY, including using switches.

COPY 0:,1: Copy all of disk 0 to disk 1 The COPY command will attempt to copy all files into contiguous segments which will speed the access time of DOS68 considerably.

COPY 0:,1:/L=6 Same as above except use all 24K for buffer to copy all of disk 0 to disk 1

COPY,0:,1:/L=6/P/NV/C Use all 24K for buffer to copy all of disk 0 to disk 1, without performing verification, but copying as much of the file as possible while asking for confirmation on each file to be copied.

COPY,*.$,1:,/C/L=2 Use 8K as buffer to copy all command files from disk 0 to 1 with confirmation

NOTE: The number of switches specified and the order in which they are specified is not important.

DELETE DELETE,<FILE SPEC>,[<FILE SPEC2>,,<FILE SPECN>]

The DELETE command removes a specified file or list of files from the directory of the specified unit. A number of file specifications can be included in the command line in order to delete a list of files. The number of files that can be deleted in one command line are limited only by the number of file specs that can be entered in the command line. After a file is deleted, the sectors used by the file are now available for reuse. Disk repacking is never required when files are deleted.

Examples:

DELETE,AB.123
This deletes file "AB.123" from the work drive.

DELETE,2:FILE.ONE
This deletes a file called "FILE.ONE" from the directory of disk drive 2.

DELETE,1:RENAME.$
This deletes from disk drive 1 the transient command file for the RENAME command.

DELETE,AB.123,2:FILE.ONE,1:RENAME.$
This deletes all of the above files as through each had been entered by separate commands. Any number of files that may be entered on the command line may be deleted.

EXEC EXEC,<FILE NAME>:

The EXECute command is used to process a text file as a list of commands, just as if they had been typed from the keyboard. This is a powerful feature in that it allows very complex procedures to be built up as a procedure file. When it is desirable to run the procedures, it is only necessary to type EXEC followed the file name of the procedure file. Essentially all EXEC does is to replace the keyboard entry routine with a routine which reads a character from the procedure file each time the keyboard routine would have been called. The system routines have no idea that

the characters of input are coming from a file instead of the terminal.

EXEC has the general command form:

```
EXEC,<FILE NAME>
```

where <FILE NAME> is the name of the procedure file. The default extension is type 4, which is initially 'CTL', although it can be redefined using SET. An example will give some idea on how EXEC can be used to create a system start up file. The BUILD utility should be used to create this file. The creation of this file might go as follows:

```
DOS: BUILD,START.UP<CR>          (<CR> Means type carriage return)
#: RUN,PPRINT.SYS<CR>
#: SET,CRT=F7E8,WD=0,DP=0<CR>
#:<CR>
DOS:
```

The first line of the example tells DOS68 we wish to BUILD a file called START.UP. Next the command lines are typed in just as they would be typed into DOS68. The RUN command will execute the file named PPRINT.SYS which will enter the information to drive the system printer. Next the SET file will be executed to establish the desired system parameters for the control port address at $F7E8, page WIDTH and DEPTH disabled.

* SSB has supplied EXEC at an alternate location on each DOS disk. If you are using the EXEC command to do batch processing, you may wish to use EXEC at the alternate location depending on the memory configuration in your machine. Following is a table showing where EXEC is located on each DOS68 disk:

DOS ADDRESS	EXEC	EXEC ADDRESS
$6080-$7FFF	EXEC	$3E00-$3FFF
$6080-$7FFF	EXEC5	$5E00-$5FFF
$A080-$BFFF	EXEC	$7E00-$7FFF
$A080-$BFFF	EXEC9	$9E00-$9FFF
$C080-$DFFF	EXEC	$7E00-$7FFF
$C080-$DFFF	EXECB	$BE00-$BFFF

FIND FIND,<FILE SPEC>:

FIND is command used to determine where an object file would load and what its transfer address would be.

General command format:

```
FIND,<FILE SPEC>
```

Where <FILE SPEC> specifies an object file in the binary record format used by the "SAVE" command and the SSB ASSEMBLER. (NOT the format used by CORES).

Example: Find out where FIND loads.

```
FIND,FIND.$
 LOADS FROM 0100 THRU 0267
TRANSFER ADD = 0106
```

FORMAT

FORMAT is a command for the initialization of blank diskettes for use with DOS68. FORMAT must be used to prepare every disk to be used by DOS68. FORMAT is invoked by either of the following two command examples:

Example 1:

```
FORMAT,<Format Parameters>
```

Example 2:

```
FORMAT(cr)
```

FORMAT will prompt the user with the following message:

```
** SSB FORMATTER V1.3 **

 /#  PRINT SWITCH SETTINGS
 /?  HELP
```

The first command example will cause FORMAT to format the disk according to the specified format parameters. At the conclusion of the formatting operation, control is returned to DOS68.

The second example will cause FORMAT to be loaded and initiated, indicating its operational readiness by its "FMT:" prompt. The user may now enter the desired formatting parameters. After the command line is terminated, the FORMAT program will format the specified disk. After the disk is formatted, the FORMAT program will retain control by displaying its "FMT:" prompt. The user can repeat the last format operation with control 'D, or alter the switch settings as required.

If the command is repeated, the FORMAT switch settings used during the previous formatting operation remain in effect in the next formatting operation unless otherwise specified by the user.

To return back to DOS68, type a BREAK character or a carriage return. after the FMT: prompt will cause control to return to DOS68.

The general format of the commands following the "FMT:" prompt is as follows:

[<unit #>]/[<options>]

If a unit number is not entered, FORMAT will assume drive 0. If a unit number is supplied, it must be one of the numbers 0, 1, 2 or 3. Options, if used, are of the form: /<option>/<option>.

OPTION SYMBOL	FUNCTION:
#	Print the options currently in effect
?	Print a summary of available options
F	Fast Mode; do not verify
Q	Quiet Mode; do not print track # or bad sector messages during verification
D	Format a double sided disk
S	Format a single sided disk
8	Format an 8" disk
5	Format a 5" disk
A	Copy DFM68 overlay files onto new disk

The options D, S, 8 and 5 have default values corresponding to the type of disk on which FORMAT is distributed and normally need not be changed. The A, F and Q options may be turned off by preceeding the command symbol by a minus sign.

Options remain in effect until either FORMAT is terminated or the option is overridden. For example: /-F overrides /F and vice versa. To determine what the defaults are type "FORMAT/#".

There are certain errors which are considered fatal by FORMAT. The printout of these messages are preceeded by "FE: ". Fatal errors cause the current process to be aborted. Such a fatal error might be:

FE: BOOT ERROR: XX

which means the sector for the boot program is bad. "XX" represents a hardware error code which indicates the cause of the error.

The /A option allows the user to copy the DFM68 overlay files onto the newly formatted disk. If the user prefers not to have the overlay files copied over to the new disk, the option switch /-A must be used.

GETH GETH,<FILE SPEC>[,<OFFSET>]:

The GETH command is used for loading the object files created by older programs that generated the MOTOROLA "S1" and "S9" type records. See the description of the "GET" command.

LINK LINK,<FILE SPEC>:

The LINK command tells the bootstrapping routine which program to load and run when the rom bootstrap routine is executed.

For example: LINK,MON causes the linkages on the work drive to be set up such that the file "MON" will be run when this disk is booted in. LINK,2:NEWMON similiarly links the boot on disk two to "NEWMON". In this case, in order to then boot "NEWMON", you must move the disk with "NEWMON" on it down to drive zero before the ROM boot is executed.

LIST LIST[,<UNIT>]:

The LIST command types the contents of the directory for the disk unit number specified. The "disk directory" is the list of file names contained on a given disk. If no unit is specified, unit zero is assumed. An optional title line may be printed by specifing the unit number followed by a statement of any length. Examples:

```
LIST                    List directory of disk 0
LIST,0                  List directory of disk 0
LIST,2                  List directory of disk 2
LIST,0, 1 A DIRECTORY   List directory of disk 0 with added
                        title line "1 A DIRECTORY"
```

The format of the directory listing is as follows:

```
    LIST,2, 2 DIRECTORY

              FILES DISC NO. 2 DIRECTORY

FILE NAME  FTFS BTBS ETES NSEC   FILE NAME  FTST BTBS ETES NSEC
ABC   .1   0200 8042 8043    2   FILE  .ONE 0100 8044 8047    4

 FREE SECTORS=1915      COMMANDS

FILE NAME  FTFS BTBS ETES NSEC   FILE NAME  FTFS BTBS ETES NSEC
APPEND.$   0200 804A 804A    1   BASIC  .$  0200 804B 8098   78

 FREE SECTORS=1915
```

The file names are under the heading "FILE NAME" followed by information about the file. "FT" is the file type (e.g. 02 for a sequential file and 04 for a random file). "FS" is file status and are non-zero only when the file is active (i.e. non-zero indicates the disk linkages are in a questionable state from the file not being closed properly). "BTBS" is the starting disk address of the file, "ETES" is the ending disk address for the file, "NSEC" is the number of sectors being used by the file.

Disk addresses are given by a four digit hex number. The first two digits are the track number beginning with $80 representing track #0. The second two digits are the sector number beginning with $40 representing sector #0. The number of sectors used and

the number of free sectors are given in decimal.

The LIST command will first list all the non-transient files on the disk and then will list all of the monitor transient commands resident on the disk. The command file names are listed with the '$' extension in the "FILE NAME" column.

RENAME RENAME,<THIS>[.$],<THAT>[.$]:

The RENAME command changes the name of "THIS" file to "THAT".

For example:

RENAME,FILE.BIN,FILE.$
On the work drive the file "FILE.BIN" is renamed to the command file name of "FILE".

RENAME,FILE.ONE,FILE.1
On work drive the file "FILE.ONE" is renamed to "FILE.1"

RENAME,2:THIS,THAT
On disk drive 2, the file "THIS" is renamed to "THAT".

RENAME,LIST.$,LI.$
On the work drive, renames the command file "LIST" to command file "LI".

REPAIR REPAIR,<UNIT NUMBER>:

REPAIR is a command designed to facilitate disc patching for the recovery of files accidentally deleted or files which have a sector that cannot be read.

This documentation is restricted to explaining what REPAIR will do for you and makes no attempt to explain the magical things which can be done by using REPAIR. These magical things are accomplished by understanding what all the information means in the SSB DISK SYSTEMS MANUAL and in the "DOS68 SYSTEM PROGRAMMERS GUIDE".

General command format:

REPAIR,<unit number>

This loads the REPAIR command and prepares it to work on the disc in drive <unit number>. REPAIR will prompt with:

REP:

when it is ready to accept a command.

REPAIR executes the following commands:

R	Read
D	Display
C	Change sector buffer
N	Read next sector
P	Read previous sector
W	Write
U	Change disc unit number
X	Exit to DOS68

All input to REPAIR is done through the use of the monitor line input routine which makes the usual command editing features available. Note that the commas in the following command descriptions may be replaced by any valid delimiter (in particular, a space).

COMMAND DESCRIPTIONS:

R READ

Format: REP: R,<track number>,<sector number>

The specified sector is read into the sector buffer. REPAIR masks the track number with $7F and the sector number with $3F allowing these to be input either way as shown below:

REP: R,83,51 (Read track 3, sector $11)

or equivalently,

REP: R,3,11

D DISPLAY

Format: REP: D

REPAIR prints the current sector address followed by the contents of the sector buffer displayed both in HEX and in ASCII on the terminal. ASCII characters less than $20 are displayed as a period. (NOTE: REPAIR was written to produce an easily read display on a SOROC IQ 120 terminal with a 24 by 80 character display. The display may need to be modified for different terminals.)

The display is formatted with 16 bytes per line by 7 lines. Each byte is identified by its offset into the buffer which is shown as row and column headings. Thus the 17th byte of the buffer (offset of $10) is in row 1 column 0.

C CHANGE

Format: REP: C,<starting byte offset>,<new contents list>

Change allows for modifications of the sector buffer for updating the disc. For example: to change byte $31 (see D description for location this byte) to a value of $53, the following command

is used:

REP: C 31 53

To convince yourself that the change has been made, use the D command. Note: this only changes memory, the disc has not yet been updated; this is done with the write (W) command.

Several consecutive bytes may be changed as shown in the following example:

REP 31 53 54 55

This example changes 3 bytes starting at byte 31.

N READ NEXT
Format: REP: N

The sector specified by the forward linkages (in the sector buffer) is read into the sector buffer and the previous, current, and next sector addresses are listed.

P READ PREVIOUS

Format: REP: P

The sector specified by the backward linkages (in the sector buffer) is read into the sector buffer and the previous, current, and next sector addresses are listed.

W WRITE

Format: REP: W

The contents of the sector buffer are written to the current sector on the disc (the current sector address is shown with each disc read and when the D command is used).

U CHANGE UNIT

Format: REP: U <unit number>
The current disc unit number is changed to <unit number> where <unit number> may be 0, 1, or 2. The contents of the sector buffer are unaffected.

X EXIT

Format: REP: X

REPAIR exits to DOS68.

SAVE SAVE,<FILE SPEC>,<SA>,<EA>[,<TA>]

The region of memory specified as starting at <SA> through location <EA>, inclusive, is saved in binary format into the file specified. Multiple regions of memory may be specified by repeating the <SA> and <EA> sequence for the number of regions required. <TA> is an optional starting address for use by the run command. If <TA> is not specified, no transfer address is written to the file. When the SAVE command is used to save transient monitor commands by using the '$' extension, a <TA> is required to be included.

For example:

SAVE,1:MEMORY.LOW,0,1000
$0 thru $1000 is saved into a file called "MEMORY.LOW" on disk 1

SAVE,2:SPOPN.$,0100,2000,0100
A command file is saved on disk 2.

SAVE,CMD.$,0000-007F,0200-037E,0200
A command file is saved on the work drive in two blocks with a transfer address. (NOTE: The '-' character may be used to aid in readability only. Any non-hex character will denote address separation.)

SAVET SAVET,<FILE SPEC>,<SA>,<EA>[,<TA>

The SAVET command is used exactly like the SAVE command. The file is loaded at $0100 vice within the Transient Command Area thus allowing the saving of command files that are currently loaded within the transient area.

SAVET,2:CMD.$,7080,7180,7080
A transient command file is saved on disk 2.

SAVET,CMD.$,7080-7180,7280-7380,7080
A transient command file is saved on the work drive in two blocks with a transfer address.

SDC SDC,<FILE SPEC>[,MEM MAX]:

The SDC (single drive copy) command allows users of single disk drive systems to copy files from one disk to another disk by reading the entire file into memory, prompting the operator to change the disk, and then writing the memory image to the new disk. Thus the user is limited to copying files which will fit into memory.

The SDC command assumes that the user has 16K of RAM origined at 0, and that the disk drive in the system is unit zero. The upper limit of memory may be changed by specifing a value for <MEM MAX> in hexidecimal if more than 16K of RAM is available.

SET SET,<PARAMETER LIST>:

The SET Parameters command is provided so the user may control the characteristics of the terminal. With this command, the action of of the terminal input and the display output may be controlled.

The general command format is:

SET,<PARAMETER LIST>

where the parameter list is a list of parameter names, each followed by an equals ('='), and then by the value being assigned. Each parameter must be separated by a comma or a space.

The default number base for numerical values is the base most appropriate to the parameter. In the descriptions that follow, 'hh' is used for parameters whose default base is hexidecimal, 'dd' is used for those whose default base is decimal.

The following fully describes all of the SET Parameters available to the user. Their initial values are defined, as well as any special characteristics they may possess.

BS=hh Back Space character

This sets the 'backspace' character to the character having the ASCII hexidecimal value of 'hh'. This character is initially a 'control H'(hex 08), but may be defined to any ASCII character. The action of the backspace character is to delete the last character typed from the terminal. Setting BS=0 will disable the backspace feature.

DL=hh Delete Line

This set the 'DELETE LINE' character to the hex value 'hh'. This character is initially a 'CONTROL X' (hex 16). The action of the delete line is to 'erase' the current input line before it is accepted into the computer for execution. Setting DL=0 will disable the line delete feature.

DP=dd DePth

The DePth parameter specifies the number of lines to be displayed before an end-of-page pause occurrs. The occurrance of an end-of-page pause requires the WAIT to be ON. As an example, with DP=24 and WAIT=ON, 24 lines will be output and an end-of-page pause will occurr. To resume the output, the CONT character must be typed. If DP=0, then the DePth control is disabled.

WD=dd WiDth

The WD parameter specifies the number of characters to be displayed on a physical line at the control terminal. Lines of text longer than the value will be 'folded' at every multiple of WD characters. The WD parameter is initialized at 80 characters.

If WD is set to 0 the width feature will be disabled, and any number of characters will be permitted on a physical line.

NULLS=dd Null count

This parameter sets the number of non-printing (Null) 'pad' characters to be sent to the terminal at the end of each line. These pad characters are used so the terminal carriage return has enough time to return to the left margin before the next printable character is sent. The initial count is 0. Users of non-CRT terminals may want to set NULLS since pad characters are sometimes required on these types of terminals.

EJ=dd EJect count

This parameter is used to specify the number of 'eject lines' to be sent to the terminal at the bottom of each page. If the value is 0 (which is the default value), no 'eject lines' are issued. An eject line is simply a blank line (carriage return/line feed) sent to the terminal. This feature is especially useful for terminals or printers with fan-fold paper so as to skip over the fold.

WAIT=ON or WAIT=OFF Pause control

This parameter enables(WAIT=ON) or disables(WAIT=OFF) the end-of-page pause feature. If WAIT is on and DP (depth) is set to some non-zero value, the output display is automatically suspended at the end of each page. The output may be restarted by typing the "CONT" character. If WAIT is disabled, there will be no end-of-page pausing. This feature is useful for those using high-speed CRT terminals to suspend output long enough to read the page of text.

STOP=hh STOP character

The STOP character is used to stop output from being displayed. The STOP character, whose ASCII hex value is 'hh', is initially $1B, the ESC character. You can use the STOP character, for example, to temporarily halt the listing of a file being VIEWed, a directory LIST, or an assembler listing. If the STOP character is typed before the end of a line is reached, DOS68 will proceed to display the remaining portion of the line and then stop prior to issuing a carriage return -line feed sequence. Once the output has stopped, the output can be resumed on receipt of a CONT character.

CONT=hh CONTinue character

The CONTinue character is the funcional complement ot the STOP character. The CONT character, whose ASCII hex value is 'hh', is initially $1B, the ESC character. The CONT char. is used to continue output to be displayed once it has been stopped using the STOP char. Since the STOP and CONT chars. are initially set to the same ASCII code ,$1B (ESC) the effect of the ESC key will be that of a switch which toggles the output off and on with each ESC keystroke. If you prefer separate codes for STOP and CONT,

simply SET STOP or CONF to the ASCII code you prefer.

BREAK=hh BREAK character

The BREAK character whose ASCII hex value is 'hh', is defined to be the system BREAK character. The initial value of BREAK is $03, which is a control 'C. The BREAK character is used to abort a command while its output is being displayed , after entering a STOP character, or when an end of page pause is encountered. For example, if you just started VIEWing a long file, and you suddenly discover that you entered the wrong file name, just type a BREAK character and you'll get back to DOS fast. You can now correct the situaution and try again.

EXT=d,<EXT> Define the default extension of an extension Type.

The decimal EXTension Type 'd' is defined to be the character string of <EXT> of up to 3 characters in length. The default extension definition feature of SET gives you the capability of defining the extension used as the default extension by programs which implement default extension assignments. Programs which offer default extensions, or which assign extensions, do so according to an extension type. The table below enumerates each of the extension types, along with the initial definition, and its use. By assigning default extensions to suit your particular file naming conventions, you can truly have it "your way".

TYPE	INITIAL DEFINITION	USE
0	BIN	Default extension for formatted binary object files created by the Assembler.
1	TXT	Default extension for Editor files and Assembler input files.
2	SRC	A source file.
3	BAS	A BASIC program
4	CTL	Default extension for control or procedure files that are processed by EXEC, and procedure files that are created by BUILD.
5	BAK	Reserved extension to be used only by the Editor for generating backup files.
6	DAT	A data file.
7	FOR	A FORTRAN program.
8	TMP	Reserved extension to be used only by the Editor for naming temporary work files.
9	' '	Spare - user definable.

UCT User Command Table clear

This parameter will clear a User Command Table extension that may currently be in effect, which will effectively clear the extension without need of re-bootstrapping DOS68 to disable the User Command Table extension.

DATE=<DATE STRING> Define date

The system DATE can be specified by a character string of up to 15 characters in length. Any ASCII character, excluding control characters and commas, can be included in the string. The comma serves as the delimiting character for separating the last character in the string from the next parameter definition on the command line. The format of the date string is left to the the users discretion, however SSB suggests using the format:

DAY MTH DD YYYY

LC=ON or LC=OFF Set lower case LoCk ON or OFF

The lower case LoCk parameter controls the representation of lower case characters on the system terminal. The LC parameter internally controls the lower to upper case character conversion within the generalized character output routine. If the LC parameter is ON, a lower case character output to the system terminal or printer will appear as an uppercase character. Moreover if LC=ON, lower case characters recieved from the system terminal will be echoed by DOS68 as upper case. If you are using a terminal which does not respond gracefully to lower case characters, SSB suggests that the LC be set ON. If LC=OFF, the lower to upper case conversion is inhibited, allowing lower case characters to be displayed as such.

MEMAX=hhhh Define memory allocation limit

The MEMAX parameter is an address defining the upper limit for workspace allocation by system or user programs. Programs which utilize the MEMAX parameter will not attempt to utilize memory beyond MEMAX if MEMAX has been set. (If MEMAX = 0000 it is not set.) Thus, if you wish to "protect" a region of memory, set MEMAX to an address just below that of the region of interest. Similarly, you can set MEMAX equal to the address of where your "user" memory ends to tell DOS68 and other programs how much memory is available to them. The MEMAX parameter is accessable to user programs.

CRT=hhhh CRT control port address

This parameter will allow changing the default control port address. The port at this address is checked for the entry of the BREAK and STOP characters and does not change the port specification of the system ROM monitor character input routine. The CRT address must specify the address of a compatible serial interface to which the system terminal is connected. Compatible interfaces are the SER-2 and MPS types which use the ACIA (6850) device. The CRT address must specify the status register of the ACIA. If the CRT address is set to an interface not connected to the system terminal, an incompatible interface, or an incorrect address, the BREAK and STOP features will be effectively disabled. * Note, the "port address" utilized by CRT refers to the lower address of the A or B side of the interface.

HC=hhhh Hard-Copy (printer) port address

This parameter will allow changing the hardcopy port address to that of another compatible interface. The selection of a port address to which a compatible interface is connected is required for the correct functioning of the 'PRINT.SYS' drivers. If multiple hard-copy devices are available but are interfaced using identical I/O cards located at different port addresses, changing the device address will allow utilization of each device without the need for loading a different driver. * Note, the "port address" utilized by HC refers to the lower address of the A or B side of the interface.

SY=h and WK=h Setting SYstem and WorK drives

These parameters allow specification of the SYstem and Work drives. The system drive is used by DOS68 as the default for command names or in general, the first name on a command line. The work drive is used as the default on all other file specifications within a command line. As the system is initialized, both the system and working drives are set to drive 0.

ECHO=hhhh Define ROM monitor echo control address

This parameter will allow specifying the input character echo control location of the ROM monitor. This address defines the location used by the ROM monitor to suppress outputting of input characters when the value in the location is non-zero. If the ROM monitor does not support this feature set 'ECHO=FFFF'.

VIEW VIEW,<FILE NAME>[,<LINE COUNT>]:
VIEW is a command for typing the contents of an editor text file. An optional line count is provided for CRT users and if specified will cause the typeout to pause every <LINE COUNT> number of lines.

General command format:

VIEW,<FILE NAME>[,<LINE COUNT>]

If <LINE COUNT>, a hex number, is zero or not specified, the entire file will be typed without pausing. In responce to a pause, a carriage return will terminate the listing; all other characters will cause the listing to continue. Note that the pause feature of the ESCAPE character within the system parameter will also function to halt the file viewing whether or not a line count is specified.

DOS68 COMMAND ERROR MESSAGES:

DOS68 prints only its prompt character unless an error condition occurs. The following are error messages which can be generated by DOS68:

CMD NOT FOUND. DOS68 could not find the command as being memory resident or disk resident.

? DOS68 does not understand the format of the command entered. Try again.

ILL FILE NAME. A file name was entered incorrectly. Try typing the line again.

NOT HEX NUM. An invalid digit was encountered in a hexadecimal number. Check the value and try again.

NO TA. No transfer address was found on the transient command or the file to be RUN. The file was loaded but DOS68 does not know where to begin execution.

CS ERR: XXXX. A checksum error has occured during the reading of a binary file. XXXX is the address of the object record being loaded. The file has been written on (most likely by someone trying to patch the file). The file should be deleted and replaced with a backup copy.

CLOSE ERR: XXXX. DOS68 has attempted to close a file left open by some program but the information in the File Control Block (FCB) needed to determine how to close the file is not valid, thus DFM68 cannot close the file. This is usually caused by a program corrupting the contents of the FCB. The only cure for this error is too cold start DOS68 (it may be advisable to reboot DOS68 since part of DOS68 may also have been corrupted by the offending program.

DISC ERR: XX. A Disk File Manager (DFM) error has occurred. XX is the DFM error code indicating the nature of the error. Refer to the ERROR CODES in the DFM Programming Tables to interpret the error code.

WRITE PROTECT:

Each 5" diskette has a small rectangular cutout on one edge. Covering the cutout with a piece of OPAQUE TAPE will write protect the diskette from an accidental write. An attempt to execute any command that would write to the diskette will return an error message.

Some 8" diskettes also have a write-protect feature, however, its operation is just opposite that of the 5" diskettes. If the cutout is NOT covered, the diskette is write-protected. You must cover the cutout to have the disk operate normally. Not all 8" disks have a cutout. If the disk has a cutout, it is located towards the left on the edge of the diskette first inserted into the disk drive.

CREATING NEW DISKS:

This section describes how to build backup disks.

It should be noted that it is not necessary to have a copy of the DOS68 operating system on every disk used by DOS68. it is only necessary to have the system present on the disk from which the system is to be boot loaded.

STEP 1: FORMAT A DISK

The first step in building a new disk is to format a new disk. DOS68 is supplied with a command called "FORMAT". FORMAT is a program which initializes blank soft sectored diskettes (see the section on formatting new disks).

STEP 2: COPY ALL DESIRED FILES TO THE NEW DISK.

SINGLE DRIVE SYSTEMS:

To copy files between diskettes on a single drive disk system, a transient monitor command called "SDC" (Single Disk Copy) has been provided. SDC allows for the reading of a file into memory, giving the operator time to change diskettes, and writing the file back out to the new disk (see the transient command description of "SDC").

Repeatedly use SDC to copy all desired files from the old disk to the new disk.

Single disk systems owners must have the DFM68 overlay files on all diskettes if the user is planning to use any of the random file features of DOS68.

MULTIPLE DRIVE SYSTEMS:

On multiple drive systems the transient monitor command "COPY" is used to copy files from disk to disk. The BACKUP command will

copy all files plus the boot-time linkage information to the copy of the master disc.

Assuming the newly formatted disk is in drive one and the old system disk is in drive zero, the following command will copy all the files from disk one to disk zero:

```
COPY 0: 1:     or     BACKUP
```

NOTE: PREPARING SYSTEM DISKS

A "system disk" is a disk which contains at least the DFM overlay files, and possibly a LINKed copy of DOS68. The non-presence of the DFM overlays will generate a "non system disk" error if DFM requires a disk resident function handler.

If the disk being prepared is to be used to boot from a cold start, the disk must contain a copy of DOS68 and the disk must be "LINKED" by executing the following monitor command:

```
LINK,1:DOS68.5XX   (Assuming the new disk is in drive one)
                   ("XX" is the latest revision number)
```

(the LINK command serves to tell the booting program which file is to be loaded and executed when the ROM booting routine is used.)

START UP:

The start up sequence is initialized during the "COLD START" of DOS68. The user may execute the start up sequence at any time by use of the procedures outlined below.

The general command sequence is:

```
EXEC,START.UP
```

where EXEC is the command file processor and START.UP is the name of a text file containing the sequential commands necessary to configure the software to the system hardware.

DOS68 will present this command to the command recognizer each time the system is cold started. This requires that the utility EXEC and a file named START.UP exist on the system disk from which DOS68 is bootstrapped.

An example of a START UP file that will initialize the system was constructed utilizing the BUILD utility. The command sequence to build this follows:

```
DOS: BUILD,0:START.UP
#: RUN,PPRINT.SYS
#: SET,CRT=F7E8,DP=0,WD=0,EJ=0
#: (cr)
```

The BUILD will cause the file named START.UP to be created on the

disk drive #0. The remaining commands perform:

1. RUN,PRINT.SYS
   This command runs the file PRINT.SYS on the work drive which will activate the system printer vectors for use by the P command. Since this file is run at system initialization the work drive defaults to drive #0.

2. SET,CRT=F7E8,DP=0,WD=0,EJ=0
   This command defines the CRT control port to be located at $F7E8 and disables all CRT formatting controls.

   More exotic START.UP command files may be devised at the users option and installed on the system disk.

PART 4: DOS68 SYSTEM PROGRAMMER'S GUIDE:

INTRODUCTION

The Smoke Signal Broadcasting disk operating system, DOS68, consists of two distinct programs:

(1) The monitor portion (TMON), and
(2) The Disk File Management portion (DFM68).

The monitor portion of DOS68 handles all other functions of DOS68 not handled by DFM68.

DFM68 is strictly a Disk File Management system and can be used independently of the monitor portion of DOS68 when the user wishes to manipulate disk files.

The following sections provide the necessary interfacing information for the user to be able to make use of the functions available through DOS68.

SYSTEM EQUATE FILE:

DOS68 is supplied with a general system equate file named SYSEQU.TXT. This file contains all the DOS68 equates necessary for system programs to interface with TMON and DFM68. Included are the equates for the monitor's entry points and parameter table, DFM linkages, DFM programming and return codes, and more. SYSEQU.TXT is intended to be used by the system programmer as an equate file to be included in the file list when assembling your system programs. If you make a hardcopy listing of it, the file serves as a handy reference guide for programming DOS68.

MONITOR SYSTEM:

This section describes the user interface to the DOS68 monitor.

MONITOR ENTRY POINTS:

The first portion of the monitor contains a jump table for accessing several commonly used routines which are present within the monitor. The layout for the table is as follows:

ENTRY ADDR	ENTRY NAME	FUNCTION:
$7280	ZCOLDS	Monitor cold start
$7283	ZWARMS	Monitor warm start
$7286	ZOUTEE	Character output routine
$7289	ZINCH	Character input routine
$728C	ZMON	JMP to ROM monitor
$7291	ZFLSPC	Get a file specification
$7294	ZGCHAR	Get current character from the line buffer
$7297	ZGNCHR	Get the next character from the line buffer
$729A	ZANCHK	Check for alphanumeric
$729D	ZDIE	Print command string, error message, and exit
$72A0	ZGETHN	Get a hex value from the line buffer
$72A3	ZADDX	Add the B register to the index
$72A6	ZOUTST	Print a string
$72A9	ZTYPDE	Type the disk error message
$72AC	ZOUTHX	Print a byte in hex
$72AF	ZOUTHA	Print an address in hex
$72B5	ZLINEI	Input edited line from the terminal
$72B8	ZLP	FORTRAN Line printer output vector
$72BB	ZPEEK	Peek ahead at next char. in line buffer.
$72BE	ZOUTCH	User alterable output vector.
$72C1	ZPUTCH	Directed output vector.
$72C4	ZGETCH	Input directed vector.
$72C7	ZSTAT	Terminal input status
$72CA	ZRESTR	Restore I/O vectors
$72CD	DCMDLN	Call DO processor.
$72D0	ZEXCMD	Execute command
$72D3	ZLOAD	LOAD - File loader
$72D9	ZNAMEJ	Decode name and jump.
$72DC	ZCRLF	Print carriage return and line feed
$72DF	ZSTEXT	Enter user default file extension.

ZCOLDS - Monitor cold start:

This entry to DOS68 resets the processor's stack and all internal status of both the monitor and DFM. The banner:

DOS68 VX.YR

is printed on the terminal where VX.YR represents the version number. After initialization, the START.UP file is executed. DOS68 then proceeds to do a warm start.

ZWARMS - Monitor warm start:

This entry to DOS68 resets the processor's stack, sets $A048 to the address of 'ZWARMS' for subsequent restarting, closes any files that may have been left open, and then prompts the operator for a new command by typing the prompt 'DOS: '.

ZOUTEE - Character output to the control terminal:

This JMP is used for output to the user's terminal. This JMP is always set to use "OUTEEE" at $E1D1 within the resident ROM. It is assumed that the output routine preserves the B register and the X register but not necessarily the A register (the data to be output).

ZINCH - Character input from the control terminal:

This JMP is used for input from the user's control terminal. This JMP is set to use "INEEE", $E1AC, within the resident ROM. It is not possible to patch this address to refer to some other routine. User programs should use the ZGETCH routine, rather than calling ZINCH, because ZINCH does not check the SYSTEM PARAMETERS. It is assumed that the B and X registers are preserved and that the character input is returned in the A register. DOS68 assumes that INEEE does not automatically echo input back to the terminal.

ZMON - Jump to ROM monitor:

The monitor "EXIT" command uses this jump to give control to some other resident monitor. This jump is set to $E0E3 to cause entry into the resident ROM.

ZFLSPC - Get a file specification:

"FILE SPEC" is a routine which is used to pick up a unit number and file name from the input buffer in the form:

[<UNIT NUMBER>:]<FILE NAME>[.<EXTENSION>]

The line buffer pointer is assumed to be pointing to the

delimiter of the previous field. To use ZFLSPC, the X register must contain the address of a File Control Block (FCB) in which the unit and file name is to be put (see FCB format description). NOTE: ZFLSPC clears the FCB starting at FCB+0 through FCB+37 before picking up the file specification.

ZFLSPC returns with the carry set if an error occurs. If no error occurs, the FCB will have the properly set up unit number, file name and file extension if specified. If no drive number is specified the working drive number will be used. The A register will return with the delimiting character of the file name. If the file specification includes the command extension '$', the '$' extension is positioned within the FCB file extension, the next character/terminator is retrieved and the file name expansion is terminated.

No registers are preserved. The line buffer pointer is left pointing to the delimiting character.

ZGCHAR - Get current character:

This routine returns the character currently being pointed to by the line input buffer pointer.

NOTE: When control is given to a program, the line buffer pointer is pointing to the delimiter of the command name. Therefore, this routine must not be called until either ZGNCHR, ZFLPSC, or ZGETHN has been used since the line buffer pointer is initialized to point to the character preceding the line buffer.

ZGNCHR - Get the next character:

This routine advances the line buffer pointer by one and returns the character being pointed to. Once a carriage return character is returned, the pointer will no longer be advanced and carriage returns will be returned with each call. This routine exits through the ZANCHK routine thus returning the character classification.

ZANCHK - Alphanumeric check:

The character in the A register is checked for being $30-$39 or $41-$7A. If the character is not within these inclusive limits, the carry bit will be set on return. Otherwise the carry will be cleared. The A, B, and X registers preserved.

ZDIE - Abort command and give error:

This routine prints the contents of the line buffer to the left of the line buffer pointer, followed by '?', followed by the text of an error

message pointed by the X register (printing stops when a null is found in the error message). After printing the error message, control will return to the monitor through the warm start entry.

ZGETHN - Get a hex number:

This routine returns the value of a HEX number found in the line buffer. ZGETHN starts by doing a ZGNCHR and continues to collect hex digits until a non-alphanumeric is found. Upon return, the line buffer pointer is left pointing to the delimiting character, the value is returned as a 16 bit value in the X register, and if the carry is not set, indicating no error occured, the A register will contain the terminating character, and the B register will be non-zero if any hex digits were found.

ZADDX - Add the B register to the index register:

The value in the B register is added to the value of the X register and the sum is returned in the X register. The B register will hold the low order sum, and the A register is unaffected.

ZOUTST - Output a string:

The character string pointed to by the X register is output to the terminal. The output stops when a null, $00, is encountered. The X register is left pointing to the null upon return.

ZTYPDE - Type disk error:

This routine is used to print the message "DISK ERROR: XX". The X register is assumed to be pointing to an FCB whose error status will be printed as the DFM error code "XX".

ZOUTHX - Output a byte in hex:

This routine prints two hex digits corresponding to the byte of memory pointed to by the X register. The A register is destroyed; the B and X registers are unchanged.

ZOUTHA - Type two bytes in hex:

This routine prints four hex digits corresponding to the two bytes of memory pointed to by the X register. The A register is destroyed, the B register is preserved, and the X register is returned advanced by one to point to the low order value printed.

ZLINEI - Line input routine:

This routine accepts a line of data from the terminal. The following characters have special meaning to the input routine:

CARRIAGE RETURN: Terminates the input
DELETE LINE (YDLINE): Restart line input
BACK SPACE (YBSCHR): Delete the previous input character

The edited information is put into the line input buffer and the buffer pointer is reset to point to the character position preceding the line buffer. A carriage return line feed pair is echoed upon receipt of the carriage return ending the input.

ZLP - FORTRAN Line printer output vector.

This entry point is reserved for the SSB FORTRAN line printer output vector. No other programs should use this vector.

ZPEEK - Peek ahead at next character.

This routine "peeks" ahead at the next character pointed to in the line input buffer, and returns it in the A register without causing the line buffer pointer to be advanced. Once a carriage return is returned, subsequent ZPEEK calls will continue to yield carriage returns.

ZOUTCH - Output character

The ZOUTCH routine usually does the same as ZOUTEE, however, ZOUTCH may be changed by programs to refer to some other output routine. For example, ZOUTCH may be changed to drive a line printer. ZOUTCH is called by ZPUTCH routine if the parameter 'YOSWT' is equal 0. A warm start entry or a call to ZRESTR resets the ZOUTCH vector to the ZOUTEE vector and sets the YOWST switch to zero.

ZPUTCH - Output character

This routine outputs a character in the A register to an output device, honoring system parameters as necessary. The column count is checked, and a new line is started if the current line is full. If an ACIA is being used to control the terminal it is checked for the entry of a BREAK character. If a BREAK character is detected, then the routine will jump to the address specified as the abort vector by the parameter 'YABORT'. If a BREAK character wasn't detected, then the terminal is checked for the entry of a STOP character. If a STOP character is detected, then the output will pause at the end of the line. During the end of

line pause, the terminal is checked for the entry of the CONTinue character. If the CONTinue character is detected, then the output will be resumed. If the 'YOSWT' parameter is non-zero, the routine ZOUTEE is called to process the character (i.e., forces output to control terminal). If the 'YOSWT' parameter is zero, the routine ZOUTCH is called. Normally, ZOUTCH sends the character to the terminal via ZOUTEE. The user program may, however, change the address portion of the ZOUTCH entry point to go to another character output routine, such as a printer driver, etc.

ZGETCH - Get character

This routine gets a single character from the control terminal, and, returns it in the A register to the calling program. The current line counter is cleared. Because this routine honors system parameter controls its use is preferred to ZINCH.

ZSTAT - Get terminal input status:

This routine checks the control terminal ACIA for data ready and returns the Data Ready status in the carry register. If the carry is set then data ready is set, if the carry is clear data is not ready. Note: if the parameter YCPORT in the system parameter table is zero, this routine will return a not ready status.

ZRESTR - Restore output vectors:

This routine forces the ZOUTCH jump vectors to point to ZOUTEE. The output switch 'YOSWT' is set to zero. The X and A registers are changed by this routine.

DCMDLN - Do Command Line entry:

This routine is a reserved vector used by DOS68 for EXEC file control. No application program is authorized use of this vector location.

ZEXCMD - Execute command:

This entry point allows any user written program to pass a command string to DOS68 for processing. DOS68 will return control to the user program on completion only if the programs called by the command execute an RTS to exit. Otherwise, control may be return to DOS68 as is normally done at completion of most utilities. The command string may be placed anywhere in memory

and the line pointer (YLINAD) and reset pointer (YLINPT) established to point to the location preceding the first character of the command string. The command string must terminate with a carriage return and null ($0D00).

ZLOAD - Load file:

On entry, the X register must contain the address of the FCB which has been opened for reading the desired file. This routine is used to load binary files only, not text files. The file is read from the disk and stored in memory, normally at the load addresses specified in the binary file itself. It is possible to load a binary file into a different memory area by using the load address (YOFSET) location. The 16-bit value in the load address (YOFSET) location is added to the addresses read from the binary file. Any carry generated out of the most significant bit of the address is lost. The transfer address, if any is encountered, is not modified by the load address (YOFSET). Note that setting a value in the load address (YOFSET) does not modify any part of the content of the binary file. It does not act as a program relocator in that it does not change any addresses in the program itself only the location of the program in memory. On exit, the transfer address flag (YTAFLG) is zero if no transfer address was found. This flag is non-zero if a transfer address was encountered. The transfer address (YTADDR)location contains the last transfer address encountered. The file is closed on exit. If a disk error is encountered, an error message is issued and control is returned to DOS68 at the warm start entry.

ZNAMEJ - Decode command name and jump

This routine, when called with the address of a properly formatted user command table in the index register, will search the table for a match against a command name in the DOS FCB (DOSFCB). If a match is found, ZNAMEJ will call the command as a subroutine, and return with the carry bit clear. If a match is not found in the command table, ZNAMEJ will return with the carry bit set. You should refer to the section entitled USER COMMAND TABLE for the command table format that ZNAMEJ expects.

ZCRLF - Print a carriage return line feed:

This routine, in addition to outputting a carriage return and line feed, checks and responds to several parameter conditions. On entry, the routine checks for a STOP character having been entered while the line was being printed. If so, the routine waits for a BREAK character or a CONTinue character to be entered. If a BREAK char. is entered, the routine jumps to the address contained in the YABORT vector of the parameter table. Unless changed by the user program, the YABORT vector set to the DOS68 Warm Start entry point (ZWARMS).

Hoewver, if a CONTinue character is entered or it wasn't necessary to wait for one, the line count is checked. If the line count equals the last line of a page and the wait on end of page (WAIT) is on, the routine waits for a BREAK character or a CONTinue character, as above. Note that all waiting is done before the carriage return/line feed is printed. The carriage return/line feed are printed, followed by the number of nulls specified by null count (NULLS). If the end of page is encountered on entry to this routine, an 'eject' is performed by issuing additional carriage return, line feeds and nulls until the total number of blank lines specified by eject count (YEJECT) is reached.

ZSTEXT - Set default file name extension:

On entry the X register should contain the address of the FCB into which the default extension is to be stored if there is not an extension already in the FCB. The B register, on entry, should contain a numeric code indicating the extension type to be used. The codes and extension values set are described below. If there is already an extension in the FCB, this routine returns to the calling program immediately. The extension types, as referenced by the value in the B register, are:

0 - BIN	5 - BAK
1 - TXT	6 - DAT
2 - SRC	7 - FOR
3 - BAS	8 - TMP
4 - CTL	9 -' ' (spare)

It is important to note that (1.) Any extension as referenced by its extension type is alterable using the SET command, so if an extension has been re-defined, ZSTEXT will set the default extension as defined per extension type, and (2.) Any extension type other than the values shown above are ignored with the routine returning without setting an extension. All registers are preserved.

USER COMMAND TABLE:

When a command line is processed by DOS68, the monitor resident command table is checked first. If the command is not found, then the user command table is checked. If the command is still not found, the disk directory is checked for the command. If still not found, "RUN DENIED" is output to the terminal.

At UCTBL in system parameter table are two locations which are normally zero indicating that there are no user resident commands present in memory. If these locations are not zero they are assumed to be the address of the user command table.

The format of the user command table is as follows:

```
START   FCB     5           Length of command (must be 1 - 6)
        FCB     2           Minimum number of characters which
                            Must be entered by the operator
                            for a match
        FDB     CMDADR      Address of user command
        FCC     /MYCMD/     Text of command name
        FCB     0           0 means end of table
                            (table may contain any number of
                            entries)

        ORG     UCTBL       Tell DOS68 about this table
        FDB     START
```

In the above example, DOS68 will transfer to location 'CMDADR' if the operator types in any one of the following:

```
MY
MYC
MYCM
MYCMD
```

When control is passed to the user command, the input line buffer pointer is left pointing to the character delimiting the command name so that the user may request the monitor to pick up parameters from the command line (see the monitor jump table descriptions).

The user should exit his command processor by doing a jump to the monitor warm start entry point.

CREATING TRANSIENT MONITOR COMMANDS:

The file "SAVET" contains a program to facilitate the creating of new transient monitor commands.

Since the monitor 'SAVE' command is a transient program, it cannot be used to save a new transient routine (if the new routine resides in the Transient Command Area) since the SAVE command itself will be called into the Transient Command Area (TCA) destroying the program to be saved. Hence, 'SAVET' is a resident version of the transient SAVE command.

SAVET is used identically to the SAVE command. The only difference is that the SAVET program will load at location $0100 vice within the Transient Command Area.

NOTES ON MODIFYING DOS68 OR TRANSIENTS:

Executable object files are stored on the disk in a binary record format. This implies that if it is desired to patch an object file (such as DOS68 or the transient commands) the user should load the program into memory, make the changes, and then write a new file out to the disk. The user can directly modify the disk only if the checksum for the record being changed is also updated. In order to be able to do this the user must first read and understand the Motorola MINIBUG-II binary object record format since this is the format used by DOS68.

An alternative method of patching an object file is to append to the file a file containing object records which load the patches into place. When the object file is loaded, the original file will be loaded, the patches will be loaded, and once the end of file has been reached, DOS68 will then transfer to the starting address.

DISK FILE MANAGMENT SYSTEM - DFM68

This section is directed toward how to use DFM68 and how to interpret the disk structure used.

INTRODUCTION:

DFM68 is a disk file management program written for Motorola 6800 based microcomputers using Smoke Signal Broadcasting's disk controller.

DFM68 provides the interface between user programs and the disk hardware by maintaining the information necessary to allow the user to transmit data to and from disk files on a character-by-character basis.

By providing this interface, the user program need not be concerned with:

1) The actual mechanics of reading and writing the disk,
2) What files are on the disk and where they are located,
3) Allocating and de-allocating of disk space.

The user need only be concerned with:

1) The name of the file to be operated upon,
2) The operation to perform (e.g., read or write)
3) The physical drive upon which the file resides.

DFM STRUCTURE:

The user need not be concerned with the internal structure of DFM other than to understand its effect upon the operation of the system. To the user, DFM consists of three parts:

1) The kernel The kernel portion of DFM interfaces user requests with the appropriate function processor. The kernel is always present in memory and contains common subroutines used by several request processors.

2) The resident function handlers. The frequently used function processors, and certain special function processors, are kept in memory for faster access.

3) The Disk-resident function handlers. Infrequently used function processors are kept in DFM overlay files on the system disk. These DFM overlay files are expected to exist on the currently "logged" system drive (see QLOGD and QLOGE functions; also see Appendix A for the system file names and which functions they contain). These system files need not be present on all disks; the system files need only be present on the current system drive when one of the functions they contain is to be used.

USING DFM:

All requests for services are communicated to DFM by means of a file control block (FCB). The FCB is a table in RAM memory which contains information such as the file name, operation to perform, unit number of disk for the file, and the disk I/O buffer space.

In order to operate on a file the file must must be "OPENED". Opening the file establishes the linkages to be able to transfer data to or from the file. Subsequent data transfers are then made by passing a byte of data through the A register. After all data transfers are complete, the file must be "CLOSED". Closing the file updates all information on the disk regarding the file.

FILE TYPES:

DFM supports sequential and random access file structures. Each file type has two subtypes. A sequential file may be either a binary file or an ASCII text file. Random access files may be either byte addressable or record addressable.

SEQUENTIAL FILE OVERVIEW:

The two types of sequential files are binary and ASCII text. DFM makes no assumptions as to the file's contents in binary mode and treats the file as a stream of 8-bit bytes. In ASCII text mode, however, DFM assumes that all characters are 7-bit ASCII characters and DFM will provide transparent blank compression thereby possibly reducing the overall file size for a typical text file.

RANDOM FILE OVERVIEW:

The two types of random files are byte addressable and record addressable. These two types exist to facilitate the access of data depending upon the application program.

Random files are treated as an ordered collection of bytes. In byte mode, the user can specify which byte of the file is be operated upon next by suppling a byte address (a number from 0 to one less than the file size). In record mode, the user specifies which fixed length record is to be operated upon next.

FILE CONTROL BLOCK FORMAT:

This section describes the entries within the File Control Block (FCB) used to access disk files and to communicate with DFM.

The FCB is a table 166 ($A6) bytes in length for sequential files and 320 ($140) bytes in length for random access files.

The user must allocate one FCB for each file being operated on at any one moment. There is no restriction upon how many FCBs may

be in use at any time thus allowing the user to operate on as many files as desired from within any single program.

SEQUENTIAL FILE CONTROL BLOCK STRUCTURE

The format of the FCB for sequential files is as follows:

NAME	LOCATION	USAGE:
XFC	FCB+0	Function code
XES	FCB+1	Error status returned to caller
XUN	FCB+2	Unit number for operation
XFN	FCB+3	1st character of file name
	FCB+4	2nd character
	FCB+5	3rd character
	FCB+6	4th character
	FCB+7	5th character
	FCB+8	6th character of file name
	FCB+9	1st character of the file extension
	FCB+10	2nd character of the extension
	FCB+11	3rd character of the extension
XFT	FCB+12	File type
XFS	FCB+13	File status
XFSU	FCB+14	Track # of first sector used by the file
	FCB+15	Sector # of the first sector used by the file
XLSU	FCB+16	Track # of the last sector used by the file
	FCB+17	Sector # of the last sector used by the file
XSUC	FCB+18	High order count of sectors used by the file
	FCB+19	Low order count of the sectors used by the file
	FCB+20	Reserved
	FCB+21	"
	FCB+22	"
	FCB+23	"
	FCB+24	"
	FCB+25	"
	FCB+26	"
XNFP	FCB+27	High order address of next FCB in active FCB chain
	FCB+28	Low order address of next FCB in active FCB chain
XBI	FCB+29	Index into data buffer
XCT	FCB+30	Track # of current sector on disk
XCS	FCB+31	Sector # of the current sector on the disk
	FCB+32	Reserved
	FCB+33	"
	FCB+34	"
	FCB+35	"
	FCB+36	"
	FCB+37	"
	(Disk I/O buffer begins with the next byte)	
XNT	FCB+38	Track of next sector in the file
XNS	FCB+39	Sector of the next secotr in the file
XPT	FCB+40	Track of previous sector in the file
XPS	FCB+41	Sector of the previous sector in the file
XSOD	FCB+42 - FCB+165	Data portion of disk sector

The FCB entries from FCB+3 through FCB+26 are the exact entries to be found in the disk file directory.

RANDOM FILE CONTROL BLOCK STRUCTURE

The format of the FCB for random files is as follows:

NAME	LOCATION	USAGE:
XFC	FCB+0	Function code (See note 1)
XES	FCB+1	Error status
XUN	FCB+2	Unit number
XFN	FCB+3	File name
	...	
	FCB+11	(Last character of file name)
XFT	FCB+12	File type
XFS	FCB+13	File status
XFSU	FCB+14	First sector used (track number)
	FCB+15	First sector used (sector number)
XLSU	FCB+16	Last sector used (track number)
	FCB+17	Last sector used (sector number)
XSUC	FCB+18	High order count of sectors used by file
	FCB+19	Low order count of sectors used by file
XRFS	FCB+20	Random file size high (See note 2)
	FCB+21	Random file size middle
	FCB+22	Random file size low
XRHBW	FCB+23	Highest byte written high (See note 2)
	FCB+24	Highest byte written middle
	FCB+25	Highest byte written low
	+26	Reserved
XNFP	FCB+27	Address of next active FCB
	+28	(low order address)
XRBA	FCB+29	Random file byte address high (See note 2)
	+30	" " " " middle
	+31	" " " " low
XRIM	FCB+32	Random file increment mode (Also called XRIF during random file creation)
XRID	FCB+33	Random file initialization data constant

(The remainder of the FCB is to be used only by DFM)

FCB+319 Last byte of FCB

NOTE 1: The random and sequential file FCBs are identical in function in bytes FCB+0 through FCB+19.

NOTE 2: In byte mode these three bytes are treated as one 24-bit binary logical byte number. In record mode, the high and middle order bytes are used as a 16-bit record number and the low order byte is a 0 through 255 byte offset within the record. This note applies to both file size (XRFS) and byte address (XRBA).

DISK FILE DIRECTORY:

The directory of files present on the disk begins in sector 1 of track zero. The format of the directory is as follows:

BYTE	USAGE:
0	Track # of next directory block (0 if end of directory)
1	Sector # of next directory block
2	Track # of previous directory block
3	Sector # of previous directory block

The four bytes above are then followed by five File Information Blocks (FIBs). A FIB is the information contained in the FCB entries from FCB+3 through FCB+26 with one exception in the case of the first directory block.

The first directory block (track 0 sector 1) only describes four files. The first FIB is used to point to the start and end of the list of available sectors on the disk. The format of this first FIB is as follows:

BYTE	USAGE:
4	MUST BE $FF
5 - 14	Don't cares ($FF)
15	Next available block track number
16	Next available block sector number
17	Last available block track number
18	Last available block sector number
19	High order count of available sectors
20	Low order count of available sectors

INTERFACING WITH DFM:

There are three entry points into DFM68; they are:

1) The DFM68 initialization entry point
2) The DFM68 closing entry point
3) The DFM68 I/O service request entry point

These three entry points correspond to three "JMP" instructions located in the first nine bytes of DFM68 (see the memory map for specific addresses).

DFM INITIALIZATION ENTRY POINT (ODFM):

DFM68 must be initialized before it can be used. Initializing DFM basically tells DFM that there are no files currently in use.

The entry point to initialize DFM is the first of the three jumps located in the beginning of DFM. There are no errors associated with initializing DFM since no disk operations are performed and since the function of this call is to reset all internal status flags within DFM68. Initializing DFM also logs drive 0 as as the system drive (see the QLOGD function description).

DFM CLOSING ENTRY POINT (CDFM):

When no further use is to be made of DFM68, DFM should be "closed". Closing DFM serves to close any open files which may not have been closed.

DFM is closed by calling the second of the three jumps located in the beginning of DFM. Errors are reported as follows: a "BNE" will branch if an error occured. If an error occured, the error type is returned in the A register (see the Appendix C for the error types), the error number will be returned in the B register, and on type 1 and 3 errors, the X register will be pointing to the FCB which is in error.

DFM I/O SERVICE REQUEST ENTRY POINT (DFM):

All service requests made to DFM are handled by calling the third of the three jumps located in the beginning of DFM.

Information regarding the functions to be performed by DFM are passed to DFM in the FCB. The address of the FCB is loaded in the X register when DFM is called. All registers are preserved by the call unless data is returned to the caller. The condition codes are not preserved; Upon return from DFM, a "BNE" will branch if an error occurred. If an error occurs, the error status byte in the FCB will contain the error code, otherwise, the error status byte will be zero.

The following is a desciption of the actions of the various functions available through DFM. The function and error code values can be found in the DFM PROGRAMMING TABLES

QFREE: REPORT FREE SPACE:

DFM68 will return the count of available sectors for the disk drive requested in the FCB. The high order binary count will be returned in the A register and the low order count in the B register.

QDEL: DELETE A FILE:

The file specified in the FCB is deleted from the disk directory and the sectors used by the file return to the list of available sectors. The same function code is used to delete both random and sequential files.

QREN: RENAME A FILE:

The file specified in te FCB will be renamed to the new file name specified in FCB+45 through FCB+53 unless the new file name consists of all nulls (00). The remaining bytes in the FIB will be changed to the contents of FCB+54 through FCB+68 unless FCB+54 (the new file name XFT) is zero. If the new file name is null

and FCB+54 is zero, then the RENAME FUNCTION will not change the existing FIB on the disk, but will copy it into the FCB in the usual place (FCB+3 through FCB+26) effectively implementing a "LOOKUP" function.

The same function code will rename both random and sequential files.

QAPP: APPENDING TWO FILES:

The file whose name is specified in bytes FCB+45 through FCB+53 is appended to the file specified in the FCB and is then deleted from the disk directory. Both files are assumed to reside on the disk drive specified in FCB+XUN. The nulls filling the unused portion of the last block of the first file remain (i.e., the files are not compressed together).

Random files are not allowed to be appended to other random files or to sequential files.

QDIRI: DIRECTORY READ SETUP:

This command causes DFM to open the disk directory specified in FCB+XUN. Subsequent calls using the directory transfer code are then used to to pick up one File Information Block (FIB) at a time until an end-of-file condition occurs.

QDIRT: DIRECTORY TRANSFER:

The directory transfer command is used to retrieve a file name at a time from the directory. This function may only used following a directory setup command or following another directory transfer command, otherwise unpredictable results will occur. The transfer command causes the next active FIB entry to be copied from the directory into bytes FCB+3 through FCB+26 (see directory format description).

QRAFC: READ ACTIVE FCB CHAIN:

The QRAFC command provides the user with a means of locating the FCBs that DFM considers to be "active". "Active" can be though of as meaning containing valid status information for accessing a file.

The caller places an ordinal number in FCB+XFN and calls DFM. DFM will return the FCB address in bytes FCB+XFN+0 and FCB+XFN+1. If the ordinal is 0 then DFM returns the first FCB address in the active FCB list; if the ordinal is 1 then DFM returns the second, and so forth. DFM will return an address of zero if the ordinal exceeds the number of active FCBs or if there are no active FCBs. This function is not available in DOS revisions below 4.0.

QLOGD: LOGGING A SYSTEM DRIVE:

DFM must be told on which disk to expect to find its three overlay files if the drive is to be other than drive 0. On calling ODFM, DFM logs drive 0 as the default system drive. If it is desired to change the system drive, the user may do so be calling DFM with the contents of FCB+XUN equal to the new system drive number. This function is not available in DOS revisions below 4.0.

QLOGE: EXAMINE SYSTEM DISK LOG:

The user can determine which drive is the logged in as the system drive by the QLOGE function. The QLODE function will return the system drive number in in FCB+XUN. This function is not available in DOS revisions below 4.0.

QSSR: SINGLE SECTOR READ:

The single sector read command causes a specified sector to be read from the disk and placed in the FCB data buffer. NOTE: A 166 ($A6) byte FCB must used with this command.

The track number and sector number to be read is placed in bytes FCB+30 (XCT) and FCB+31 (XCS) respectively; the track number must be a value between 0 and 34 and the sector number a value between 0 and 17.

NOTE: The error code returned from this command is the actual value read back from the WD 1771 chip with the least significant bit being used to indicate a seek error in which case the error bits reflect the type I command error bits.

QSSW: SINGLE SECTOR WRITE:

The single sector write is the counter part of the single sector read command (see above descripton).

WARNING: Single sector I/O allows any sector to be read or written. It is up to the user to know what he is modifying.

SEQUENTIAL FILE ACCESS

QSO4W: OPEN A SEQUENTIAL FILE FOR WRITE:

DFM68 creates the file to be written by the name specified in the FCB. An error will occur if the file already exists (a file cannot be automatically overwritten). The caller must specify the file name, unit number, and file type. If the file type (XFT) contains the code for a compressed (i.e. ASCII) text file (a file type of FTCS; See appendix for file type codes) then DFM will perform blank compression otherwise the file will default to

the binary sequential file type. WARNING: set only those bits in the file type byte (XFT) which are specified in Appendix B (the other bits are will be used in future versions of DOS68).

QSWRIT: WRITE TO A SEQUENTIAL FILE:

The byte of data passed in the A register is written to the file specified in the FCB used to open the file.

QSWC: CLOSE A SEQUENTIAL WRITE FILE:

The file specified in the FCB is closed. That is, the last buffer of data is written to the file and the directory entry for the file is updated. If the last buffer is not full, it will be padded with nulls. When the file is read back, an end-of-file condition will not occur until the last character of the last buffer has been read.

QSO4R: OPEN A SEQUENTIAL FILE FOR READ:

The file specified in the FCB is opened for read. The caller need not worry whether the file being read is a compressed ASCII file or whether the file is a binary file. DFM will automatically expand the blanks which it compressed when the file was written if the file was written in the compressed mode. The caller need only supply the unit number and file name to open the file. The caller may examine the lower four bits of the file type (XFT) byte after the file has been sucessfully openned if it desired to know whether the file was written in the compressed mode.

QSREAD: READ FROM A FILE:

The next byte is read from the file specified in the FCB and returned to the caller in the A register. Note that the nulls padding the last block of the file wiil be returned to the caller as if they were originally written to the file. DFM will not inform the caller of an end-of-file condition until the last byte has been read from the last block. Thus, it is advised to ignore nulls in text files and nulls following records in object files.

Also, note that it is not necessary to write a special end-of-file character out to a disk file. By examining the error status returned by DFM it is possible to determine the end-of-file by continued reading from the file until DFM returns an end-of-file error status code (see appendix of error status codes).

QSRC: CLOSE A SEQUENTIAL READ FILE:

DFM releases the linkages to the file being read. The FCB is now free to used for another file.

RANDOM FILE ACCESS

QCRF: CREATING A RANDOM FILE:

Random files differ from sequential files in that random files are created by a separate request to DFM other than the request to open the file, and that random files are of fixed size specified by the caller at the time of creation. To create a random file the programmer must supply the following information:

1) The unit number on which to create the file is placed in FCB+XUN.

2) The name of the file is supplied in FCB+XFN and follows the usual DFM file naming rules.

3) The file type is supplied in FCB+XFT and must be either FTRB or FTRR (see DFM PROGRAMMING TABLES for file type codes). The file type will determine whether file positioning will be specified in the byte mode (FTRB) or the record mode (FTRR).

4) The size of the file to be created must be specified in the three bytes starting with FCB+XRFS. If FCB+XFT contains FTRB then the user must supply a three byte binary number representing the desired number of bytes to be in the file. If FCB+XFT contains FTRR then the first two bytes must specify the number of records desired and the third byte must be the record size (1 to 255 characters).

5) The data initialization flag (FCB+XRIF) must be non-zero to force the initialization of the files contents to the value contained in FCB+XRID. If FCB+XRIF is zero then the contents of the file are indeterminant.

From this information, DFM allocates the file space and builds the structure used to rapidly access the random data file.

NOTE: The random file is not left in an "OPEN" state. The QORF (open random file) file command must be used in order to operate upon the file.

QORF: OPEN A RANDOM FILE:

In order to read or write a random file the file must be opened by this command (QORF). To open the file the user must supply the unit number on which to find the file and the file name. DFM will handle the byte or record mode addressing depending upon the file type information found in the directory for the file. Be

aware that the random file may now be read or written and that random files require the use of a 320 ($140) byte long FCB.

The file is opened positioned to byte 0 (or record 0 byte 0) and the byte pointer increment mode is set to auto-incrementing.

The byte pointer incrementing mode (XRIM) determines what happens to the byte position within the file when a byte is read from or written to the file. If XRIM is positive then the file pointer will be incremented after the next read or write so that the next byte of the file will be operated upon next. If XRIM is zero then the byte pointer is not modified following reads or writes. If XRIM is negative then the byte pointer is decremented after the byte is read or written.

Each time DFM's byte pointer is automatically incremented or decremented, DFM will update the contents of XRBA, the random file byte address (and it will update it corresponding to the file type, either record mode or byte mode). Thus, by reading XRBA the user can tell where DFM is positioned within the file.

QPRF: POSITIONING A RANDOM FILE:

The current position within the random file can be altered by the QPRF, position random file, command. The caller sets up the byte address, XRBA, to either the byte or record position, depending upon the file type, and then calls DFM to position the file. An end-of-file error (EEOF) will be returned if the byte address does not fall within the file size and the file pointer will not be modified.

Note that in a record addressable file, the position command can be used to position into the middle of a record by setting the third byte of XRBA non-zero to indicate which byte of the record to position to.

Also, note that positioning a file will not cause the disk head to move. Movement of the disk head is postponed until a disk read or write in required.

QRRF and QWRF: READING AND WRITING A RANDOM FILE:

Read (QRRF) and write (QWRF) function identically with the exception of the direction of the data flow and so will both be covered in this description.

The data to be read or written will be passed in the A register on calling or returning from DFM. The byte position of the file to be operated upon corresponds to the cuurent byte address (XRBA). WARNING: If the user changes the contents of XRBA, the user must notify DFM of this change by using the position command to tell DFM to position to the new byte location.

DFM will adjust the current file byte position, and XRBA, as

specified by the contents of the increment mode flag XRIM. XRIM positive means auto-increment, XRIM zero means non-incrementing, and XRIM negative means auto-decrementing.

QCLSRF: CLOSING A RANDOM FILE:

Random access files must be closed by the QCLSRF command when the user is finished with the file. Closing the random file will force the last record to be written out if the file has been written to and then the FCB will be released so that it may be reused.

XRHBW: HIGHEST BYTE WRITTEN:

DFM68 keeps track of the highest byte written within a random access file. This address is kept in the directory entry for the file in bytes 20 through 22 of the FIB (Bytes 23 through 25 of the FCB). These bytes contain the value needed to position the file to the highest addressed byte within the file that has previously been written. Note that, for record mode files, bytes 20 and 21 will contain the record number which contains the highest byte written and byte 22 will contain the byte offset into the record for the highest byte written.

During file creation, XRBHW is set to $FF, $FF, $FF to indicate that nothing has been written to the file. As with all other FIB contents, XRBHW is available in the FCB while the file is open.

QERF: RANDOM FILE EXPANSION:

DFM68 Version 5 contains a convenient means for expanding a random access file once it has been created. The function code is named QERF and its value is 28. To expand the size of a random file, the programmer must supply the following information:

1) FCB+XUN must contain the unit number on which the file exists.

2) FCB+XFN must contain the name of the file to be expanded.

3) The new file size (not the amount of expansion) must be in XRBA (normally the file byte address). The new file size follows the same restrictions as creating a new file except that the record size need not be specified for a record mode file.

4) FCB+XRIF may be set non-zero if it is desired to have the newly allocated disk sectors initialized to a value passed in in FCB+XRID. Note that the previously unused bytes of the last data sector of the original file remain initialized as determined during the file creation, not as during expansion.

From this information, DFM68 allocates the required disk space to the file. The data in the original file is not modified in any manner.

USING THE DISK FILE MANAGEMENT SYSTEM (DFM):

DFM is that portion of DOS68 which relates to the usage of disk files. This section is provided as an introduction as how to use DFM to read and write disk files.

It is recommended that the reader first read through the descriptions of the functions provided by DFM. Then, after having read this section, read through several of the monitor transient command listings to see how the information presented below is implemented in practice.

HOW TO READ FROM A SEQUENTIAL FILE:

Reading from a file is done in three steps:

1) Opening the file for read
2) Reading from the file
3) Closing the file

Opening the file sets up the software linkages within DFM to enable the user to then request data be transfered from the file.

In order to open a file the user must reserve a 166 byte table in his program. This table is referred to as a File Control Block (FCB). The FCB is a table in which the pointers to the file being accessed are kept.

To read a file the user must fill in three entries in the FCB. these three entries are: a) the unit number on which to find the file, b) the name of the file, and c) the operation to perform on the file.

The function code to open the file for read is put in the first byte of the FCB. The unit number on which the file is to be found is put in the third byte of the table (the unit number may be 0, 1, 2 or 3). The nine bytes following the unit number are used to designate the file name. The first six bytes are treated as the file name while the last three are treated as the file extension.

The first portion of the FCB then looks like:

```
FCB+0 (XFC)    Operation code
FCB+1 (XES)    Error code returned to the user
FCB+2 (XUN)    Unit number
FCB+3 (XFN)    File name (1st character)
FCB+4
  .
  .
  .
FCB+8          File extension (1st character)
FCB+9
FCB+10         File extension (last character)
```

To actually open the file, load the X register with the address of the first byte of FCB and call DFM. Upon return, a "BNE" will branch if an error occured. If an error occurs at any time the

non-zero code will be returned in the 2nd byte of the FCB. The simplest manner in which to handle errors is to request DFM to close all open files. This is done by calling "CDFM", the DFM closing entry point. See the description of this entry point to DFM for further details. Thus the following section of code represents how one would open a file for read:

```
ODFM    EQU     $7780       Open DFM entry point
CDFM    EQU     $7783       CLOSE DFM entry
DFM     EQU     $7786       DFM service request entry

        LDX     #FCB        Load the address of the FCB
        LDA A   #QSO4R      Load the value of the "open for read"
                            function code
                            (see the appendices for the function
                            code values)
        STA A   XFC,X       Store the function code in the FCB
        JSR     DFM         Ask DFM to open the file
        BEQ     FILOPN      Branch if no error ocured
        JSR     ZTYPDE      Ask the monitor to
                            type "DISK ERROR: XX"
        JSR     CDFM        Ask DFM to close all files
        JMP     ZWARMS      Restart the monitor

FILOPN  LDA A   #QSREAD     Change to function code to read from
                            the file
        STA A   XFC,X
* WE ARE NOW READY TO READ DATA FROM THE FILE
```

2) To read a byte from the file, load the X register with the address of the FCB and call DFM. DFM will return the next byte from the file in the A register. If an error occurs a "BNE" will branch if an error occured (end-of-file is treated as an error condition also). The following section of code may be used to read from a file:

```
        LDX     #FCB        Point to the FCB
        JSR     DFM         Ask DFM to read a byte
        BEQ     READOK      BRA if no error occured
* IF DESIRED, "LDA A   XES,X" HERE WILL PICK UP THE ERROR CODE
* SO THAT THE PROGRAM MAY DETERMINE WHAT TO DO WITH THIS
* SPECIFIC ERROR.
        JSR     ZTYPDE      Ask the monitor to type
                            "DISK ERROR: XX"
        JSR     CDFM        Ask DFM to close any open files
        JMP     ZWARMS      Restart the monitor

READOK  EQU     *           At this point a byte has been
                            READ FROM THE FILE AND IS
                            in the A register.
```

3) After all the data has been read from the file, the file must be closed. Closing the file releases the FCB from its role as table of pointers to the file. Closing the file is accomplished as follows:

```
        LDX     #FCB        Point to the FCB
        LDA A   #QSRC       Set the function code to "Read Close"
        STA A   XFC,X       Save the function code
        JSR     DFM         Ask DFM to close the file
        BEQ     CLSOK       Branch if the file was sucessfully
                            closed
        JSR     ZTYPDE      Tell the monitor to type the disk
                            error code
        JSR     CDFM        Ask DFM to close any open files
        JMP     ZWARMS      Restart the monitor

CLSOK   EQU     *           At this point the file is closed
```

HOW TO WRITE (CREATE) A FILE:

Writing a file follows the identical sequence of operations as reading from a file with the following exceptions:

1) When opening the file, the function code is "QSO4W" to open the file for write instead of "QSO4R".

2) "QSWRIT" is used in place of "QSREAD" when perparing the file to be written.

3) When data is to be written to the file, the data must be in the A register when DFM is called.

4) When closing the file, "QSWC" is used instead of "QSRC".

(see the appendices for the function code values)

HOW TO USE A RANDOM ACCESS FILE:

1) Creating a random access file.

The follow segment of code illustrates the creation of a byte mode random access file.

```
DFM     EQU     $7786       DFM service request entry
XRFS    EQU     20          Offest into FCB to file size
XRIF    EQU     32          Offset into FCB to initialization flag
XRID    EQU     33          Offset to initializtion constant

* WE'LL ASSUME THAT THE FCB ALREADY CONTAINS THE
* FILE NAME AND UNIT NUMBER
        LDX     #5000       set low order 16 bits of file size
        STX     FCB+XRFS+1
        CLR     FCB+XRFS    clear the 8 high order bits of file size
        LDX     #FCB
        LDA A   #FTRB       set up the file type (byte or record)
        STA A   XFT,X
        LDA A   #1          set flag to force file contents
        STA A   XRIF,X      to be initialized
        CLR     XRID,X      initialize all bytes to 0
        LDA A   #QCRF       set up command for DFM
        STA A   XFC,X
        JSR     DFM         ask DFM to create the file
        BNE     ERROR       branch if an error occured
* THE FILE HAS BEEN CREATED

ERROR   JSR     ZTYPDE      type an error message
        JSR     CDFM        close any files which might be open
        JMP     ZWARMS      exit to the monitor
```

2) Opening a random access file

The following code segment will open a random access file either to be read or written:

```
* AGAIN WE'LL ASSUME THE FCB CONTAINDS THE FILE
* NAME AND UNIT NUMBER
        LDX     #FCB
        LDA A   #QORF       set up command for DFM
        STA A   XFC,X
        JSR     DFM         ask DFM to open the file
        BEQ     OK          the file is ready to be accessed
* MAY WISH TO PERFORM SOME SORT OF ERROR RECOVERY AS ABOVE
* AT THIS POINT
```

3) Reading and Writing random access files

The following code segment will position the file to byte 4000 and write "ABC" to the file.

```
XRBA    EQU     29          Offset to the byte address

        LDX     #FCB        point to FCB used to open the file
        CLR     XRBA,X      high order address = 0
```

```
        LDA A   #4000/256   mid order byte address
        LDA B   #4000       low order byte address
        STA A   XRBA+1,X
        STA B   XRBA+2,X
        LDA A   #QPRF       set up command to position the file
        STA A   XFC,X
        JSR     DFM         position the file
        BEQ     POK         branch if positioned OK
PER     JSR     ZTYPDE      give an error message
        JSR     DFM         and quit
        JMP     ZWARMS

POK     LDA A   #QWRF       perpare write function code
        STA A   XFC,X
        LDA A   #'A
        JSR     DFM         write a byte
        BNE     PER
        LDA A   #'B
        JSR     DFM
        BNE     PER
        LDA A   #'C
        JSR     DFM
        BNE     PER
* THE THREE BYTES HAVE BEEN WRITTEN
```

To read from the file, QWRF is replaced with QRRF and DFM will return the byte read in the A register.

PART 5: DISK SYSTEM HARDWARE

PREFACE

This section describes the characteristics of the SSB floppy disk controller board.. This interface allows users of the Chieftain or other SS-50 bus 6800 micro- computer system to easily interface up to four 5" disk drives or four 8" disk drives. Either single or double sided disk drives may be used.

BOOT AND I/O ROUTINES

To facilitate disk I/O a ROM has been provided on the disk interface board. The ROM contains all necessary I/O routines to read, write, seek, step and restore the disk drives. In addition, a disk boot routine has been included in the ROM. In Chieftain systems, the ROM has been removed from the controller board and incorporated in the monitor ROM on the CPU board.

DISK CONTROL

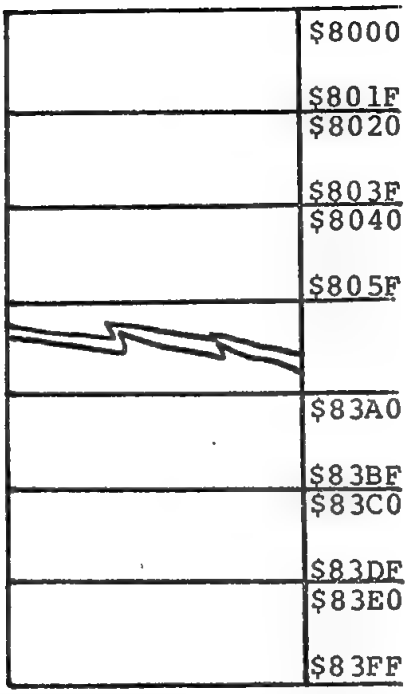
Disk control is achieved by the use of the Western Digital FD1771B-01 floppy disk controller IC. This IC controls read/write format, head step, seeking, and checks the write protect status of the disk. The read/write format can be programmed to many formats including IBM 3740 format. CRC generation and checking are also performed within the FD1771B-01 IC. Additional information on programming the floppy disk controller chip may be found in the Western Digital FD1771B-01 product guide.

FD1771B-01 CONTROL

All communications between the host system and the FD1771B-01 IC are through a 6821 PIA. Control line functions of the FD1771B-01 are handled by the A-PORT and other programmable control input/output pins of the PIA. Data to and from the floppy disk chip is transmitted through the B-PORT of the PIA.

ROM

The ROM located at U5 provides 512x8 bits of information for the user. The ROM addressing is decoded to use all unused addresses in the I/O page between $8020 and $83FF. The 9324 decoder U7 provides high order address decoding. Use of unused areas of the I/O page is achieved by requiring address bit 5 to be true to enable the ROM. Address bits 0-4 of the ROM are driven by address lines 0-4. Address bits 5-8 are driven by address lines 6-9. The figure below illustrates the interleaving of I/O and ROM addresses.



NOTE: In Chieftain systems, the ROM routines reside in the Chieftain monitor ROM and the address space from 8000 through 83FF is available to the user.

The above figure shows I/O memory illustrated as pages of 32 words. When bit 5 is a 0, that 32 word page is used as I/O locations. When bit 5 is a 1 that page is decoded by the ROM as one of its addresses and the particular byte of information required is placed on the system data buss.

DISK INTERFACE DESCRIPTION

Address decoding for the 6821 PIA is provided for by NAND gate U19 and the 9324 decoder, U6. The 74LS30 8-input NAND gate U19 generates the non-programmable address decoding of the address bits A5-A12 at U19-8 to the CS2- input at U18 pin 23. Register selection within the PIA is controlled by address lines A0 and A1 at U18 pins 36 and 35.

NOTE: On Chieftain systems, the PIA is decoded to occupy address space F77C through F77F. On all other systems, the PIA occupies addresses 9FFC through 9FFF.

The PIA data inputs (U18,26-33) are tied directly to the the negative true system data buss. Care must be exercised in programming the PIA as the PIA expects to see positive true data at the system port. All control functions sent to the PIA should first be complemented by the controlling program. All control information received from the PIA should be interpreted as negative true data by the receiving program. the DAL- lines of the FD1771B-01 IC are tied to the B-PORT of the PIA at

U18(10-17). Data to and from the FD1771B-01 on the DAL lines is defined as negative true data. As data is not inverted through the PIA, it is not necessary to invert data from or to the FD1771B-01 as is required with the control registers of the PIA. Data exchange between the PIA and FD1771B-01 are controlled by the following control lines:

WRITE ENABLE

CB2 of the PIA is used to strobe information from the 6821 into the FD1771B-01. CRB bits 3-5 should be programmed to '101'. In this mode CB2 is cleared on the positive transition of the first 'E' pulse following a write 'B' data register operation and set high on the positive transition of the next 'E' pulse. During write operations the read flip-flop, U25, must be disabled by programming A-PORT bits 6 and 7 to 1 and 0 respectively.

REGISTER SELECT

A-PORT bits 0 and 1 drive the register select lines of the floppy disk controller chip. PA0 drives address line A0 and PA1 drives address line A1.

READ ENABLE

Reading information from the FDC is controlled by its read enable input at U17-4. This input is driven by the read enable flip-flop U25-6. Flip-flop U25 is used in two modes. Mode one is used when reading control registers in the FD1771B-01. Mode two is used when reading data from the disk. In mode one PA6 (U18-8) is programmed to '0'. PA6 low forces U25-6 to the low state thereby enabling information from selected register onto the DAL lines (U17,7-14). this information can then be read in on the B-PORT of the PIA. In mode two PA6 and PA7 (U18-8,9) are programmed to '1's. When DRQ (U17-38) comes true and PA7 is true flip-flop U25 will be set on the positive transition on the 1 Mhz clock (U25-12). DRQ is also tied to the CA2 input of the PIA (U18-39). This programmable pin is programmed as an input triggered by a positive transition (CRA bits 3-5 =110). On the positive transition of DRQ, IRQA at U18-38 will be set low (IRQA reflects the status of the bit set by the positive transition at input CA2(U18-39)). The IRQA output is used to drive the K input for read enable flip-flop U25. As long as IRQA remains active low U25 will not be allowed to reset. U25 setting causes a byte of data from the floppy disk to be placed on the DAL lines (U17-7,14). When the processor detects CRA bit 6 set it can then read the byte of data on the DAL lines though the B-port data register. After the processor has read the data from the B-PORT the flag in the A-PORT control register is cleared by reading the A-PORT data register. Reading the A-PORT data register also deactivates IRQA. This allows U25 to reset thereby preparing the floppy disk chip for the next byte of data from the disk.

HEAD LOAD TIMING

Head load time of the SA400 minifloppy is approximately 75 milliseconds. The 9602 oneshot (U9) provides the delay signal required for proper operation of the FD1771B-01. The time delay generated prevents the floppy disk controller from reading or writing before the head has had time to settle.

DISK INTERFACE SIGNALS

DISK SELECT

During operation one of four disks may be selected at any one time. Disk select is controlled by PIA A-Port bits 4 and 5. These lines are connected to a 74LS138 (U14-1,2) which decodes the signals to select one of four drives. The disk select lines are buffered by the 7417 buffer located at U22. U22 provides the required drive capability needed to drive the disk interface buss.

SIDE SELECT

PIA Port A Bit 3 is buffered by U15 and provides the side-select output for use in double sided disk systems.

MOTOR ON

The motors on 5" drives are turned on as soon as the disk is selected and will stay on as long as the disk system is accessed. U8 is wired as a retriggerable one-shot and has a period of approximately 30 seconds. After the last head load, U16-2 goes high which reverse biases D1, allowing U8 to time out. U1-5 is an inverting buffer used to drive the MON- line of the SA400 drive. 8" drives use AC motors designed for continuous duty and operate at all times for fastest disk access.

One-shot U9 is used to provide a motor start delay and a head load delay. The motor start delay is disabled by U8-3 if the motor is already running.

WRITE DATA

The Write Data signal at U17-31 is buffered and inverted by U23-12. Write data on the disk interface buss is negative true data (WR DATA-).

WRITE GATE

The Write Gate signal at U17-30 is buffered and inverted by U23-9. Write gate (WR GATE-) along with WR DATA- controls writing of data to the selected disk.

STEP

The step pulse at U17-15 is buffered to the disk interface buss by U23-2 (STEP-). The step output provides the step instruction to the disk at a controlled rate. The step rate is programmed by the user. For the SA400 the step rate should be programmed to 40 msec per step. For additional information on step rates see the Western Digital FD1771B-01 product guide available from Western Digital.

DIRECTION

The direction output of the FD1771B-01 (U17-16) is buffered by U23-5 (DIR-). For step-in (towards the disk hub) the direction line will be high. For step-out the direction line will be low (this level will be reversed on the buss).

TRACK 00

The TRACK 00 status of the selected disk is buffered by U24-2 and is ANDed to HEAD LOAD from the WD1771-1 (U17-28). This signal "fakes" the WD1771-1 into thinking it is on track 00. This allows the system to respond faster after a reset or on power up.

WRITE PROTECT

Write protect (WRT PROT-) is buffered by U24. Resistor R26 provides the required pullup. The write protect line reflects the status of the currently active disk. If the write protect hole in the disk is covered the write protect line will be low. The buffered write protect line U24-11 drives U17-36. Before doing any write operations the write protect line is sampled. If the line is low the write operations will be aborted by the controller chip.

READ DATA

READ DATA- is buffered by NAND gate U3-(1,2). It is then sent through a one-shot to shape the signal. From here there are two options: Option 1) is to use the external data separator, and option 2) is to use the data separator internal to the FD1771-1. The FDC board is configured to operate with the external data separator. The internal separator may be selected by cutting both traces labeled J-12 and inserting jumpers at both locations labeled J-13. The difference between the two separators is one of resolution; The external separator is better at rejecting jitter from an SA400, and thus it is recommended that the external data separator be used.

The external data separator consists of IC'S U1, U2, U3, U4, U11, and U16. The separator works by generating "windows" through which data and clock pulses are gated from read DATA- to the

FD1771-1. The synchronization of the separator to the incoming data is done by retriggerable one-shot U11, associated gates, and flipflops. The one-shot timing is controlled by potentiometers R18 and R19 which are set at the factory and should not be adjusted in the field.

INDEX PULSE

The index pulse is buffered by AND gate U24-9,10 (INDEX PULSE-). Pullup is provided by resistor R25. The buffered index pulse signal at U24-8 drives U17-35. This signal provides sychronization information for the floppy disk chip.

INSTALLING ADDITIONAL DRIVES

Additional minifloppy disk drives may be installed in the field. To install a second or third drive, proceed as follows:

1) Locate the drive select jumpers located in a dip socket on the top corner of the board on the disk drive.

2) The jumpers are cut as shown in the table below for SA400 drives:

DRIVE	CUT	REMOVE
0	MX, DS2, DS3	
1	MX, DS1, DS3	RESISTOR PACK 760-3-R150 OHM
2*	MX, DS1, DS2	RESISTOR PACK 760-3-R150 OHM

The jumpers are cut as shown in the table below for B51 drives:

DRIVE	CUT	REMOVE
0	DS2, DS3, MUX, HM	
1	DS1, DS3, MUX, HM	RESISTOR PACK 760-3-R150 OHM
2*	DS1, DS2, MUX, HM	RESISTOR PACK 760-3-R150 OHM

* A fourth drive (accessed as unit #3) may be installed on J4 by jumpering it the same as unit #1 on J2. Or, drives 0 and 1 may be connected to J2 and 2 and 3 connected to J4. In that case, the drives on J4 should be jumpered the same as the drives on J2.

NOTE: The resistor pack is removed from all drives except the drive which is on the end of the ribbon cable connecting to the controller (normally this is drive zero).

To install additional SA800 drives, the jumper on the back of the SA800 printed circuit board near the cable edge connector should be moved as shown below:

DRIVE	MOVE JUMPER TO
0	DS1
1	DS2
2	DS3
3	DS4

DISKETTE REQUIREMENTS

The Smoke Signal Broadcasting disk systems use standard size media with one index hole. For maximum flexibility in adapting our system to special user requirements, we use a soft-sectored disk format. Thus, diskettes designed for the specialized requirements of hard- sectored systems such as the Northstar which use multiple index holes will not work with the our disk systems. If you inadvertently try to format a multiple index hole diskette, the formatting program will report a very large number of "bad sectors".

ADJUSTMENTS FOR 5" OR 8" DRIVES

The SSB disk controller board can be used with either 5" or 8" drives, but not both. The proper PC jumpers are installed at the factory and the data separator timing adjusted for the type of drive shipped with the system. It is recommended that modifications required to make the controller operate with a different size disk drive than supplied with original system be made at the factory.